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ABSTRACT

This issue discusses world population trends and their implications for more and less developed countries. There have been two periods of major population expansion since 1750 with the first lasting almost 200 years and the second surge occurring after World War II. Growth rates in industrialized countries are now very low with fertility below replacement levels. High growth rates persist in sub-Saharan Africa and parts of Latin America and South Asia, but indications exist that these regions will soon follow the world trend toward lower growth rates. The fact that the projected increase in the world population growth will come in less developed countries (LDC) raises the possibility that population growth will restrict efforts to raise living conditions among the LDCs' poorer populations. Organized efforts to increase access to family planning information and supplies are associated with significant increases in contraceptive prevalence and declining fertility in LDCs. Since organized interventions to increase family planning awareness involve basic and often conflicting human values, population policy remains a controversial area. Graphs, charts, black and white photographs, and a 20-item selected bibliography are included. (DJC)

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POPULATION BULLETIN
Vol. 41, No. 2, April 1986

World Population in Transition

By Thomas W. Merrick with PRB staff

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Abstract—The world's population growth rate peaked at slightly over 2 percent a year in the late 1960s and in 1986 is down to 1.7 percent and falling. Annual numbers added continue to mount because these rates apply to a very large base, 4.9 billion in 1986, but will peak at 89 million a year in the late 1990s and then also taper off until world population stabilizes in the last decade of the 21st century at about 10.2 billion, according to current United Nations medium variant projections. Close to 95 percent of this growth is occurring in the less developed countries (LDCs) of Africa, Asia (minus Japan), and Latin America, now comprising 76 percent of world population. LDC fertility rates are declining, except in sub-Saharan Africa and parts of Latin America and South Asia, but most have far to go to reach the replacement level of 2.1 births per woman, although China, the world's population leader at 1.05 billion in 1986, reached that level in 1984. Fertility is below replacement in virtually all more developed countries and a few are already experiencing natural decrease (fewer births than deaths). For LDCs, large numbers will be added before stabilization even after attainment of replacement level fertility because of the demographic momentum built into their large and young population bases. This complicates efforts to bridge gaps in living standards between LDCs and industrialized countries. From a new debate about whether rapid population growth deters or stimulates economic growth a more integrated view sees efforts to slow population growth and other development efforts to improve people's health and education, upgrade women's status, etc., as complementary. Most effective in the increased contraceptive prevalence and fertility declines seen in many LDCs has been the combination of organized programs to increase access to family planning information and supplies with socioeconomic development that enhances the desire for smaller families.

Editor: Jean van der Tak

Graphics: George Hager

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World Population in Transition

By Thomas W. Merrick, with PRB staff

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A mother and child in Mauritania. Fertility rates and population growth rates are still high in sub-Saharan Africa and parts of Latin America and South Asia, but are declining in most of the less developed regions that now comprise 76 percent of world population.

World Population in Transition

By **Thomas W. Merrick**, with PRB staff

Thomas Merrick is President of the Population Reference Bureau. Formerly, he was Director of the Center for Population Research at Georgetown University, where he continues to teach. He has served with the Ford Foundation in Brazil and as consultant to a variety of international agencies.

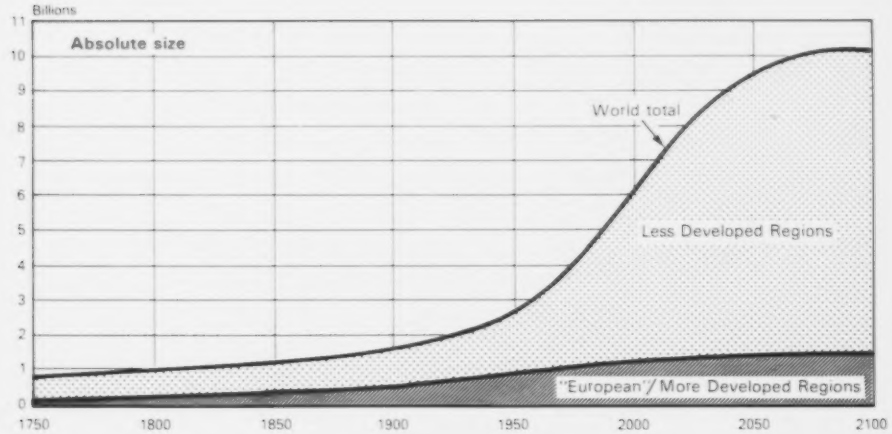
Carl Haub, Director of Demographic Analysis and Public Information at PRB, Mary M. Kent, Research Demographer, and Jean van der Tak, Senior Editor, contributed to the Bulletin. *A special section features illuminating observations by experts on "Five Key Countries in the World Population Outlook": Judith Banister (U.S. Bureau of the Census) on China; Arjun Adlakha (Bureau of the Census) on India; Edward K. Brown (World Bank) on Nigeria; Eduardo E. Arriaga (Bureau of the Census) on Mexico; and Carl Haub on West Germany.*

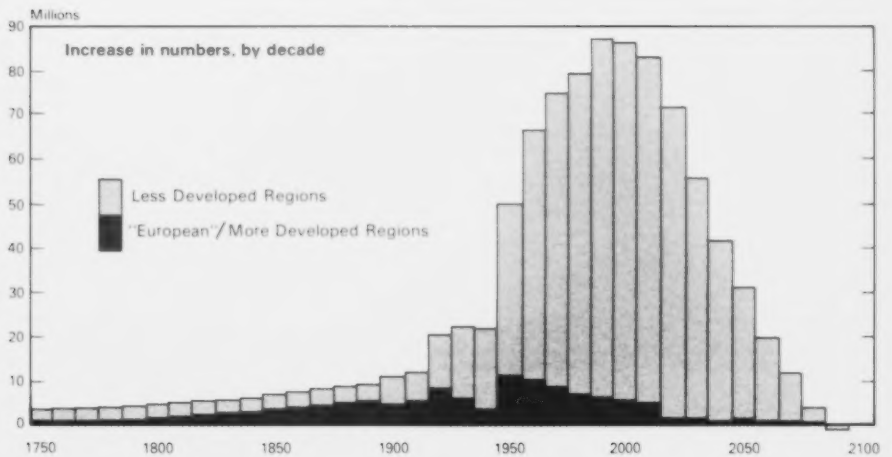
Human demographic history has reached an important turning point. World population in the spring of 1986 stands at about 4.9 billion and is growing by about 1.7 percent a year—the difference between global birth and death rates. After accelerating for more than two centuries, the annual *rate* of world population growth is slowing; today's rate of 1.7 percent is down from a peak of about 2.04 percent in the late 1960s and is expected to continue to decline, to between 1.4 and 1.5 percent in 2000 and zero toward the end of the 21st century, according to the United Nations. For most of the past and also for most of future human history, world population increase was and will be limited, both relatively and absolutely.

Annual increases in the *absolute size* of world population have also been growing for more than two centuries and since the end of World War II have reached numbers that are enormous by historical standards. Currently, some 83 million people are added to the world's population each year. In the ten years from 1975 to 1985, world population grew by about 760 million, a number equal to the estimated *total* world population in 1750. Even though the annual growth *rate* of world population is now declining, the *numbers added* each year are likely to increase for at least another decade, because the size of the base population to which this growth rate applies has become so large. According to the latest, 1984, medium variant assessments of the United Nations, numbers added to world population will average 86 million a year from 1990 to 1995 and reach a peak of 89 million a year, on average, between 1995 and 2000. In the year 2000 world population is projected to be 6.1 billion. After that, annual numbers added will be increasingly smaller until world population eventually stabilizes (see Figure 1, bottom panel, next page). The U.N.'s most recent long-range medium projection, prepared in 1980, puts this in the last decade of the 21st century at a total of about 10.2 billion (see Table 1, page 12).

Before the 18th century, high birth rates were nearly matched by high death rates and world population grew very slowly. There were periods of regional growth, but these were generally offset by declines, which were sometimes catastrophic, such as the plummet in Europe's population caused by massive numbers of deaths

Figure 1. Population Growth, 1750-2100: World, Less Developed Regions, and "European"/More Developed Regions





Sources: 1750-1900: Based on estimates by Alexander M. Carr-Saunders, John D. Durand, and Walter F. Willcox cited in United Nations, *The Determinants and Consequences of Population Trends* (New York: 1973). After 1900: Based on medium variant estimates and projections by the United Nations, Population Division, as assessed in 1963, 1980, and 1984, and projections of the World Bank, published in My T. Vu, *World Population Projections 1985* (Baltimore: Johns Hopkins University Press, 1985). Although the use of various sources introduces small inconsistencies in the time series, the resulting general pattern of past and projected population growth should give a satisfactory picture of world population trends.

Note: Three less developed regions = Africa, Asia (minus Japan), and Latin America; Two "European"/More developed regions = Europe, U.S.S.R., Japan, and Oceania (including Australia and New Zealand) combined and North America (Canada and the U.S.).
See also Table 1, page 12.

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during the plagues and famines of the 14th century. Globally, however, both relative and absolute increases were very small until the 1700s. That was when the first modern increase of world population began, as death rates began to decline. This increase was led by Europeans, both those living in Europe and those who settled in the Americas, Oceania (Australia and New Zealand), and other colonial areas. The European-based increase lasted for about 200 years. It was substantial by comparison with previous experience but moderate in relation to what has occurred recently.

After World War II, population growth rates accelerated dramatically in the less developed regions of Africa, Asia (minus Japan), and Latin America. There was also a modest population surge in a few industrialized countries which, like the United States, experienced a prolonged postwar "baby boom." As shown in Figure 1, recent population growth in the three less developed regions has been far greater than any ever experienced in the two "European" more developed regions shown in the figure—Europe, present-day U.S.S.R., Japan, and Oceania combined, and North America (Canada and the United States). The less developed regions' population bases were already large at the beginning of the post-World War II surge and during the surge, their rates of natural increase (births minus deaths) surpassed any ever experienced in regions settled by Europeans because birth rates were initially higher and declines in death rates more rapid, telescoping into a few years a population growth acceleration process that took decades in European countries. Since the less developed regions now make up over three-quarters of world population, the result has been global population increase that dwarfs any in previous human demographic history.

The current experience is also likely to be unique. Natural increase is very low in most developed countries and even negative in some Western European countries, such as West Germany, where birth rates are now lower than death rates. In the U.S., natural increase is now down to about 0.7 percent a year and immigration plays an increasing role in the country's population growth. Population growth rates have also begun to decline in many developing countries. The fertility rate of China, the world's most populous country at an estimated 1.05 billion at mid-1986, was down to the replacement level of 2.1 births per woman by 1984, which foretells an eventual end to China's population growth (see Box 1, page 6). Fertility rates have fallen by a quarter or more over the past decade in such populous Latin American and Asian countries as Brazil, Mexico, Indonesia, and Thailand. These countries still have a long way to go before births and deaths are in balance and population stabilizes, but the signs of change are strong. High growth rates persist mainly in Africa and a few low-income countries of South Asia and Latin America.

Declining or even replacement level fertility does not spell an immediate end to population growth. The reason for this is population momentum (see Box 1). While fertility *rates per woman* decline, *numbers* of births continue to grow because the numbers of new mothers grow as an echo effect of past increases in births. Only after this echo effect works itself through a population's age structure does a population stop growing. While this is happening, a country with a large population base will experience very large absolute population increases, despite declining birth rates. China is a good example. Currently, China has some 270 million women of reproductive age. If each of these women were to have just two children, more than half a billion people (allowing for some mortality in childhood) would be added to China's one billion population. It was this realization that prompted the country's leadership in 1979 to establish a policy of one child per family, to be pursued for one generation, in the hope of speeding up the goal of population stabilization.

Because of population momentum, the absolute size of world population will grow

Box 1. Population Replacement and Momentum

A population just reproduces itself when individual couples have just the number of children needed to replace themselves, allowing for some mortality in childhood. In most populations this comes to about 2.1 children per couple, or per woman. With an average higher than 2.1 children, a population will experience natural increase (more births than deaths); with less than 2.1, natural decrease. For that reason, a fertility rate of 2.1 is considered to be at the *replacement* level.

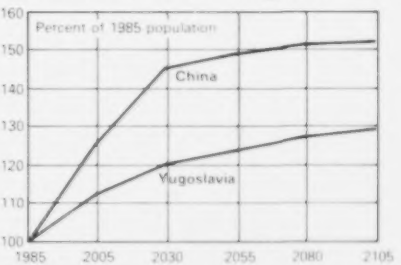
When the average fertility rate of a population reaches the replacement threshold, one would expect births and deaths to be in balance. Eventually they will be, but not immediately. The reason for this is demographic *momentum*. Demographic momentum derives from the age structure of a population that is experiencing fertility decline. A population's age structure reflects its past pattern of demographic events—mortality, migration, and, especially, fertility (see Box 3, page 19).

A population that has had very high fertility in the years before reaching replacement level fertility will have a much "younger" age structure than a population with lower fertility before crossing the replacement threshold. The proportion of young people in a population approaching replacement level fertility is important because the size of the largest recently born generation as well as the size of the parent generation determines the ultimate size of the total population when births and deaths are finally in balance. Even after replacement level fertility is reached, births will continue to outstrip deaths so long as the generation that is producing births is disproportionately larger than the older generation where most deaths occur.

A comparison of two populations crossing the replacement level threshold reveals that the one with prior higher fertility and, thus, a younger age structure will experience greater increases in population before births and deaths come into balance and the population stabilizes. China, with a 1985 population of 1.04 billion and 34 percent under age 15, is among the handful of less developed countries with fertility even close to replacement level. China's total fertility rate was 5 to 6 births per woman as late as the early 1970s but dropped precipitously to 2.1 births per woman in 1984. Even with its aggressive fertility control program, China's population is expected to increase by 135 million (13 percent) during the decade from 1985 to 1995 and to grow to 1.57 billion (a 51 percent increase over 1985) before stabilizing. Yugoslavia also recently reached replacement level fertility, but down only from a total fertility rate of 2 to 3 births per woman. Some 24 percent of its 1985 population of about 23 million was under age 15. The population is projected to increase by about 1.5 million (7 percent) from 1985 to 1995 and stabilize at about 30 million (30 percent over 1985) at the end of the next century.

While the momentum potential in China is high by comparison with that of Yugoslavia, it is low compared to that of many sub-Saharan African countries where high fertility has resulted in populations with 45 percent or more currently under age 15.

Population Momentum, 1985 to Stabilization: China and Yugoslavia



Source: World Bank projections

enormously over the next few decades. The U.N.'s medium projections of 1984 imply increases of more than 800 million people per decade in the four decades from 1985 to 2025 (see Table 1, page 12). Over 90 percent of these increases will occur in the less developed regions, mainly in Africa and Asia. Eventually, possibly after the middle of the next century, growth will subside and world population will stabilize.

Sustained population increases of

these magnitudes raise important challenges as well as major opportunities for human society. The challenges arise from pressures of increased numbers on resources, the environment, and traditional ways of earning a livelihood. The fact that so much of the growth is coming in the developing countries is a further challenge, because it coincides with these countries' efforts to bridge the large gaps in living standards between themselves and more developed countries.

The same pressures also create opportunities. Many of the adaptations in productive techniques and organization that led to the Industrial Revolution in Europe were, in part, responses to population pressures associated with the European-based increase of world population. One way that societies adapt to population pressures on resources is by developing technology to use resources more efficiently. They also reorganize to use productive methods that will support more people, with urbanization, for example, and the factory system of production. These changes generate feedbacks on demographic processes. The small-family norm is itself a product of the shift to urban living and the increased education required by modern economies. Urban-based mass markets have played an important role in the diffusion of contraception and, hence, in fertility declines.

To be sure, not all responses to population pressures have been positive. History provides a litany of plagues, famines, and wars associated with population increases that exceeded the capacity of particular localities to sustain them. For developing countries, the challenge is to adopt and adapt for their own development needs the "modern" technology and organization that brought high living standards to more developed countries and to do this in the face of very large population increases. Time is a critical factor for the poorest countries. Each decade of population growth at current numbers makes it more difficult for them to bridge the gap between themselves and the more developed countries.

Migration is another way of adapting to population pressures. Historically, movements of people in response to population pressures on land provided an escape valve for many European countries. Migration from hard-pressed rural areas fed the growth both of European cities and of populations in countries where European emigrants settled. Migration has also been an important demographic response to growing population pressures in today's developing countries. Third World cities are expected to absorb most of projected population growth and international migration of Third World peoples has increased substantially in the past two decades. These movements have important political, economic, and social impacts on both sending and receiving regions.

World population is on the path toward stabilization. Responses to population growth between now and the time stabilization occurs will shape the kind of world that future generations share. Basic living standards for large segments of the world's people hang in the balance. The impact will be greatest in less developed countries, but more developed countries will find it difficult to insulate themselves from the process, even if they try. Pessimists feel that population growth is swamping less developed countries' efforts to raise living standards. They see ominous signs that the failure of development will spill over into more developed countries through political strife and economic chaos. Those who take a more optimistic view see important signs of positive change and important precedents for change in the history of today's more developed countries. Ultimately, history will provide answers to the many questions about the impact on economic and social development of population increases of such unprecedented magnitudes.

This *Bulletin* provides a perspective on world population trends and their implications for more and less developed

countries to the extent that these can be ascertained in the mid-1980s. It presents data on trends to the present and projections for the future, reviews theories and empirical evidence on the causes and consequences of population growth, and discusses their implications for public policy.

World Population Trends and Prospects

Premodern growth: before 1750

Few countries conducted censuses before 1900 and despite efforts begun after World War II, 100 percent census coverage of the world's population has not yet been achieved. Demographers have thus had to rely on administrative records and other evidence to piece together estimates of population size in the past. For the distant and even not-so-distant past, estimates have been based on speculation about the numbers that could be supported in particular ecological settings at presumed levels of social and technological development. These estimates have been supplemented by records from secular and ecclesiastical sources and surviving contemporary observations.

One of the earliest benchmarks in estimates of world population is the agricultural revolution beginning about 10,000 years ago when humans shifted from food gathering and hunting to food growing and domestication of animals. Before that, it is estimated that a population of 5 to 10 million could have been supported. The agricultural revolution precipitated a population expansion that was pale by modern standards but large relative to previous experience.[1]

For the beginning of the Christian era, 1 A.D., another benchmark, estimates of world population range from 270 to 330 million.[2] For 1,000 A.D., the estimates are not much higher, 275 to 345 million, because of the likely demographic impact of the disruptions during and after the fall of the Roman Empire in the fifth century. World population growth rates then increased slightly, but with some major setbacks, most notably with the Black Plague that devastated Europe's population in the 1340s and 1350s.

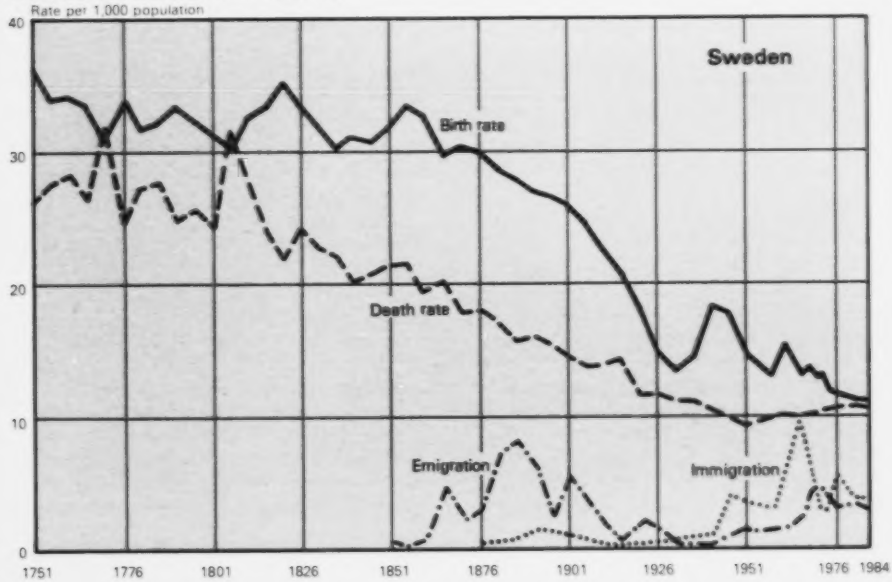
Fertility was high during this premodern era, which represents most of human history, though nowhere close to human capacity, because of poor health and nutrition and the restrictions of cultural practices and taboos. High fertility was balanced by high mortality—during infancy and early childhood, among women during childbirth, and from diseases and illnesses from which modern populations normally recover. Added to this were episodes of catastrophic mortality during epidemics, crop failures, famines, and wars. Population grew at times in particular regions but eventually declined when environmental conditions or resources could no longer sustain the increase in numbers.

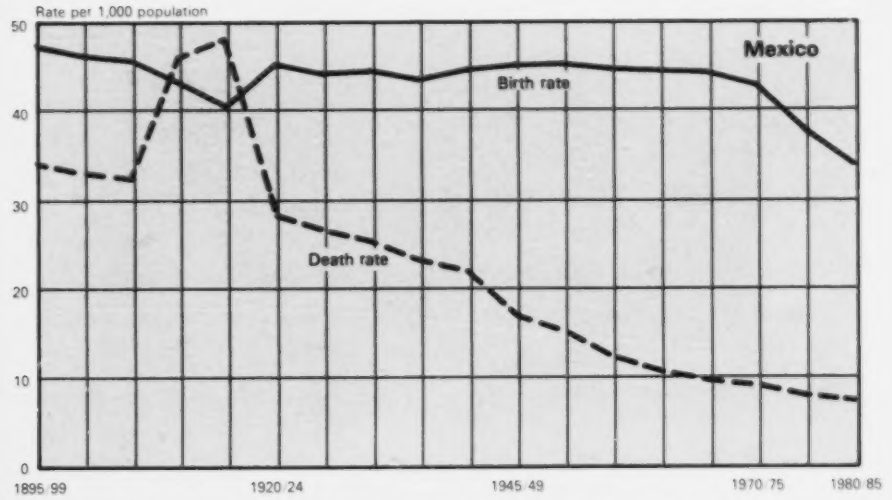
For 1750, often used as the benchmark for the beginning of the first modern expansion of world population, demographer John Durand reports estimates of 735 to 805 million.[3] Then, as now, Asia accounted for the largest share, an estimated 60 percent. Europe, including the present territory of the Soviet Union, represented another 24 percent, followed by Africa, with about 13 percent. North and South America made up only about 2 percent of the world total, less than in 1500 because their indigenous populations had by then been decimated by diseases introduced by Europeans and by wars and oppressive living conditions.

European expansion: 1750-1950

The pattern of birth and death rates shown in Figure 2 (top panel) for Sweden, which has a longer record of vital statistics than almost any other country, was typical of most European countries after 1750 and countries where Europeans settled, though the timing varied.

Figure 2. Birth and Death Rates: Sweden, 1751-1984, and Mexico, 1895/99-1980/85





Sources: Sweden: Statistics Sweden, *1986 Statistical Yearbook* (Stockholm: 1985). Mexico: 1895-1970: Francisco Alba-Hernandez, *The Population of Mexico* (Mexico: Center of Economic and Demographic Studies, El Colegio de Mexico, 1976). 1970-1985: United Nations, Population Division, *Demographic Indicators by Countries as Assessed in 1984*, New York, December 1985, computer printout.

Before the 19th century, birth and death rates still fluctuated widely, with spurts of population growth, followed by slower growth and even declines, as during famines at the beginning of the 19th century. The death rate then began a sustained decline while the birth rate remained above 30 per 1,000 population until the 1880s. The lag between the declines in birth and death rates brought a gradual rise in natural increase, as happened in most Northwestern European countries during the 19th century and in Southern and Eastern Europe in the early 20th century. In Sweden, the ensuing decline in population growth was even more marked than the decline in natural increase because of heavy emigration between 1860 and 1914. Sweden's population growth has been very low since the 1930s and its births and deaths are now virtually in balance.

Demographers call Sweden's experience from 1750 to 1950 a "demographic transition": a shift from slow population growth because both birth and death rates are high to slow growth with both rates at low levels. In between, population growth first rises as birth rates remain high while death rates decline and then slows when birth rates also start to decline.

The term "demographic transition" is also used to characterize relationships between birth and death rate declines and changing social and economic conditions. Mortality declines during the European transition are attributed mostly to improved living conditions, particularly better diets and sanitation.[4] Medical advances, such as vaccines and drugs, came comparatively late in the transition and helped control and eventually eradicate—or nearly eradicate—many infectious diseases.

The explanation of fertility declines is more complex. The "classic" demographic transition theory holds that the small-family norm is prompted by a society's shift from a rural-agrarian economy to an urban-based economy where manufacturing and services are the main activities. However, there are many exceptions to this model. In Europe, the beginning of France's fertility decline, in the late 18th century, preceded urbanization and industrialization, while the start of England's decline, a century later, came well after. This has led researchers to investigate the impact of other factors that appear to be relevant: cultural influences on attitudes about childbearing, how the idea of birth control is diffused, and the impact of improvements in women's status, particularly education.[5] Much of Europe's fertility transition took place before modern contraceptives were developed.

With the rise in growth rates, world population increase between 1750 and 1950 far outstripped any previous upturn. This was bolstered by new technologies and forms of social and economic organization that made possible the support of many more people. Global numbers passed the one billion mark during the early 1800s, added another billion by 1930, and the third by 1960.

Europe's population growth made its impact through emigration to countries in North and South America, Oceania, and Africa where Europeans settled. Although Europe, the U.S.S.R., the two Americas, Japan, and Oceania accounted for only 27 percent of world population in 1750, this had increased to 40 percent by 1950 and the combined shares of Africa and Asia had fallen from 73 to 60 percent, because 37 percent of world population growth in these two centuries occurred in Europe or in regions where Europeans settled (see Table 1, page 12). Asia (minus Japan) still added the most numbers between 1750 and 1950, 837 million, because its population was so large to begin with—455 million in 1750.

Third World growth: 1950-1985

The second, far larger modern wave of world population growth—a near doubling from about 2.5 billion in 1950 to over 4.8 billion in 1985—was fueled by

the surge in the growth rates of developing countries to levels far higher than rates during the European-based expansion and the fact that these rates applied to populations that were already large in 1950. Of the some 2.3 billion addition to world population in these 35 years, Asia accounted for 61 percent and Africa and Latin America for another 25 percent; only 14 percent was contributed by Europe (including the Soviet Union), North America (Canada and the U.S.), Japan, and Oceania combined (Table 1). Asia (minus Japan) made up 51 percent of world population in 1950 and Africa and Latin America made up 16 percent; by 1985 their combined share was up to 76 percent, reducing the share of the two more developed regions to 24 percent.

Rapidly declining death rates coupled with continued high birth rates caused the rapid acceleration of population growth rates in less developed countries (LDCs). Until the early 20th century, annual death rates in countries untouched by the European-spawned mortality decline were well over 30 per 1,000 population, comparable to rates in Europe in the mid-1700s. In the next 40 years, LDC death rates declined gradually as sanitation improved and advances in medicine and techniques for controlling infectious disease that contributed to the final phase of the European mortality decline spread slowly to non-European areas, particularly port cities with enclaves of European residents. Even so, LDC death rates were still double or more the rates of industrialized countries on the eve of World War II.

Rapid LDC mortality declines after World War II were due mostly to the development of systems for delivery of existing medical technologies to large numbers of people through mass vaccination, immunization, insecticide-spraying, etc., much of it an outgrowth of wartime efforts to keep the armed forces of industrialized countries healthy in tropical areas. By 1960 death rates in most Latin American and Asian countries were down to those of Europe, and sometimes lower, because LDCs have much higher proportions of young people whose death rates are normally low. Only Africa and South Asian countries like India, Bangladesh, Nepal, and Pakistan lagged behind.

In the meantime, birth rates remained high. In fact, they were generally in the high 40s per 1,000 population, well above the average 30-35 per 1,000 of European rates before their decline, because marriage occurred at an earlier age and was more universal than in Europe. As a result, population growth rates in many LDCs exceeded 3 percent a year by the late 1950s, more than twice the rates of any European countries at the height of their transitional population growth phase.

Mexico's experience is illustrative, particularly compared to Sweden's (Figure 2, page 9). Death rates in Mexico were over 30 per 1,000 population before 1910, rose close to 50 during the decade of revolution and civil war from 1910 to 1920, were still in the 20s in the mid-1930s, and then declined—first slowly and faster after 1945. By the early 1960s, the death rate was around 10 per 1,000 population. The birth rate, by contrast, hovered well above 40 per 1,000 population until the early 1940s, in part because the mortality decline occurred mainly among young children and mothers, which added to the nation's fertility potential by increasing the number of surviving mothers.

Most Latin American countries had a similar experience. That region led LDCs in death rate declines, followed by East Asia (China, Korea, Taiwan, etc.), South Asia, and only recently, Africa. Latin America's birth rates remained higher for a longer time so its overall rate of population growth was highest of LDC regions in the 1950s and 1960s. Since the mid-1960s, birth rates have come down in Latin America and especially in East Asia, mainly because of the precipitous drop in fertility since 1970 in China, which accounts for such a large share of that region's total population. Population growth rates have fallen since 1970 in all LDC regions except sub-Saharan Africa, where declining death rates coupled with still high birth rates

Table 1. Population Growth, 1750-2100: World and Five Major Regions

(Numbers in millions)

Region	Total population					
	1750		1900		1950	
	Number	Percent	Number	Percent	Number	Percent
World total	760	100.0	1,630	100.0	2,516	100.0
Less developed regions	569	74.9	1,070	65.6	1,681	66.8
Africa	100	13.2	133	8.2	224	8.9
Asia (minus Japan)	455	59.9	867	53.2	1,292	51.4
Latin America	14	1.8	70	4.3	165	6.6
"European"/More developed regions	191	25.1	560	34.4	835	33.2
Europe, USSR, Japan, Oceania[a]	189	24.9	478	29.3	669	26.6
North America[b]	2	0.3	82	5.0	166	6.6

Region	Absolute and percent increase during periods					
	1750-1950		1950-1985		1985-2025	
	Number	Percent	Number	Percent	Number	Percent
World total	1,756	231.1	2,321	92.2	3,369	69.7
Less developed regions	1,112	195.4	1,976	117.5	3,142	85.9
Africa	124	124.0	331	147.8	1,062	191.4
Asia (minus Japan)	837	184.0	1,405	108.7	1,706	63.3
Latin America	151	1,078.6	240	145.5	374	92.3
"European"/More developed regions	644	337.2	346	41.4	226	19.1
Europe, USSR, Japan, Oceania[a]	480	254.0	248	37.1	145	15.8
North America[b]	164	8,200.0	98	59.0	81	30.7

Sources: See Figure 1.

[a]Oceania includes Australia and New Zealand.
[b]North America = Canada and the U.S.

have boosted population growth to about 3 percent a year, as in the other regions two decades earlier.

Slower growth/larger increases: 1985-2025

Growth rates around the world should continue to drop over the coming decades (see Figure 1, Table 1, and Box 2, page 14). Even African rates are expected to pass their peak by the end of this century. The principal question is how rapid the declines will be and this depends on birth rate trends. Birth rates in many LDC countries fell faster than expected during the late 1960s and 1970s, but in Costa Rica, Korea, Sri Lanka, and Tunisia, for example, declines have stalled at fertility levels notably higher than the replacement level of two births per woman that would eventually end population growth.[6] Except for sub-Saharan Africa, death rates in most LDCs are now as low or lower than in more developed countries and what further decline may occur will not dampen the effect of falling birth rates on overall growth rates. It is also possible that death rates could rise if economic and social

1985		2000		2025		2100	
Number	Percent	Number	Percent	Number	Percent	Number	Percent
4,837	100.0	6,122	100.0	8,206	100.0	10,185	100.0
3,657	75.6	4,837	79.0	6,799	82.9	8,748	85.9
555	11.5	872	14.2	1,617	19.7	2,591	25.4
2,697	55.8	3,419	55.8	4,403	53.7	4,919	48.3
405	8.4	546	8.9	779	9.5	1,238	12.2
1,181	24.4	1,284	21.0	1,407	17.1	1,437	14.1
917	19.0	987	16.1	1,062	12.9	1,055	10.4
264	5.5	297	4.9	345	4.2	382	3.8

2025-2100	
Number	Percent
1,979	24.1
1,949	28.7
974	60.2
516	11.7
459	58.9
30	2.1
−7	−0.7
37	10.7

conditions deteriorate in some of the world's troubled areas.

Despite declining LDC growth rates, these rates are building on the very large population bases accumulated over the last few decades, so absolute increases in world population will grow, from 757 million in the 1970s, to 796 million in the 1980s, and 876 million during the 1990s, according to the U.N. 1984 medium projections, followed by a gradual tapering off in the 21st century. The U.N. medium projections put world population at 6.1 billion in 2000, as noted, and 8.2 billion in 2025.

Of the projected 3.4 billion addition to world population between 1985 and 2025, 3.1 billion, or 93 percent, occurs in Africa, Asia, and Latin America, increasing their share of global numbers to 83 percent, and reducing that of North America, Europe, the U.S.S.R., Japan, and Oceania from 24 percent in 1985 to just 17 percent in 2025 (Table 1). The largest absolute increase, 1.7 billion, is projected for Asia, again reflecting its large population base. But Asia's percentage growth in the 40-year projections, 63 percent, is below the overall average, 70 percent. Thus Asia's share of total world population drops from 56 to 54 percent.

Relative growth in Africa and Latin America is projected to top the world average by a large margin. Africa is projected to add 1.1 billion people, reaching 1.6 billion in 2025, triple the 555 million of 1985. Latin America's projected gain is 374 million, to 779 million in 2025, close to double 1985's 405 million. Africa's projected share of world population consequently rises from 12 to 20 percent and Latin America's increases by a percentage point, from 8.4 to 9.5 percent.

A word of caution is needed about both

Box 2. World Population Projections

While the need for population projections is obvious, demographers face difficult decisions regarding the *assumptions* to be used in preparing them. Assumptions must be made about the future course of birth and death rates and, in some cases, about migration.

Many factors must be considered when projecting a country's population. What is the present level of the birth rate, of literacy, and of education? Does the government have a policy to influence population growth? What is the status of women?

Along with these must be weighed the likelihood of socioeconomic change, for it is generally assumed that, as a country "develops," a preference for smaller families will cause fertility to fall to the replacement level of about two children per woman. But when can this be expected to happen in less developed countries? And for the majority of more developed countries with fertility currently below replacement level, can one assume that fertility will rise to avert eventual disappearance of the population and, if so, when?

Predicting the pace of fertility decline is most important as illustrated by the United Nations long-range projections for Africa. As with many projections, these are issued in a "series" to show the effects of different assumptions. The U.N. "low" projection for Africa assumes that replacement level fertility is reached in 2030, which would put the continent's population at 1.4 billion in 2100. If attainment of replacement level fertility is delayed to 2065, as in the "high" variant, the population is projected to be 4.4 billion in 2100. That difference of 3 billion should serve as a warning that using population projections requires caution and consideration of *all* the possibilities.

The table below summarizes the variation in the most recent U.N. long-range projections for world population according to the year when replacement level fertility is assumed to be reached.

United Nations World Population Projections: 1980-2100

Series	1980 population (millions)	Replacement level fertility[a] reached in:	2100 population (millions)
High	4,441	2065	14,199
Medium	4,432	2035	10,185
Low	4,420	2010	7,524

Source: 1980 long-range projections of the United Nations, Population Division.

[a]Replacement level fertility = Total fertility rate of 2.1 births per woman.

the magnitudes and regional distribution of population in projections to 2025. Because of its currently high birth rates and declining death rates, Africa has the *demographic* potential to grow as projected, rivaling the growth of Asia and Latin America over the last three decades. But there is no guarantee that Africa has the political, social, and economic base to support such increases. Birth rates are still stubbornly high—up to 50 per 1,000 population and more—and total fertility rates range from 6 to 8 births per woman in most countries. But a potential response to population pressures could be fertility declines much faster than those seen in other regions (except in China, where the drop in the fertility rate from 5.8 to 2.1 births per woman in just 14 years from 1970 to 1984 was largely due to strong government measures unlikely to be feasible in African countries. See description of China, page 41).

In the increase projected for Latin America, we see a reflection of the population momentum described earlier as well as some of its implications. Birth rates are falling rapidly in some Latin American countries, but because of their large population bases, numbers of births are not declining in equal proportion. The resulting population increases are projected on the population of Latin America today, but many of these people may not be living in Latin America. With the large numbers involved and the pressures they are likely to exert on debt-ridden Latin American economies, it is likely that some of the increase will spill over into North America, continuing the migration flows that have been

accelerating since the early 1970s. International migration within and out of Africa and Asia could also change the regional and subregional distribution projected for these populations in 2025.

The path to stabilization: 2025 and beyond

Population projections for the world, regions, or countries beyond 2025 are highly speculative. The mechanics are the same as for the shorter range, but assumptions about the components of population change that drive these projections require extrapolations from current trends and judgments about the shape of those trends over the next 40-100 years.

Current trends suggest that most countries of the world will complete, or nearly complete, the transition to low fertility and mortality by 2025. Fertility is already at or below replacement level in virtually all industrialized countries and in the demographically key LDC, China. Fertility is also low in other East Asian countries—Korea, Taiwan, Japan (an industrialized nation)—declining rapidly in much of Latin America, and coming down in India, the world's second most populous country at 785 million in 1986 (see description of India, page 42). Still uncertain is when and how fast the decline will be in other populous South Asian nations, such as Bangladesh and Pakistan, in North Africa, particularly Egypt with a fertility rate well over 5 births per woman and some 51 million people in 1986, and in sub-Saharan Africa, especially the largest country there, Nigeria (see description of Nigeria, page 44).

On the basis of these trends, projections beyond 2025 show world population growth slowing and global numbers stabilizing by the last decade of the 21st century, according to U.N. medium projections. However, these projections assume that fertility will level off in all countries by at least 2040 at more or less the replacement level of two births per woman. But fertility may stay higher than that in some LDCs and never again rise to replacement in the many industrialized countries where it is now much lower, as in the U.S., which has had a fertility rate of about 1.8 births per woman since the mid-1970s.

Long-range projections also do not allow for risks like nuclear war and other catastrophes. Wholesale mortality was common in the past, as with the Black Plague that killed a quarter to a third of Europe's population in the 14th century. At today's growth rates of very large populations, losses of thousands or hundreds of thousands of lives in earthquakes and typhoons are made up in a few hours or days, and even the millions of deaths during World War II did not stall the population surge since then. Nevertheless, much higher than projected mortality from risks seen and unseen in the mid-1980s is possible.

In the most recent long-range U.N. medium projections (1980), world population grows from the 8.2 billion in 2025 to about 10.2 billion before stabilizing around 2095. As in the projections for 1985-2025, Asia adds the largest numbers of the five regions shown in Figure 1 and Table 1, increasing from 4.4 billion in 2025 to 4.9 billion in 2100. Long-range projections for individual countries made by the World Bank show China stabilizing at 1.6 billion, even assuming fertility already at replacement level in the 1980s. India, with currently more than twice that fertility, about 4.5 births per woman, outstrips China and all other countries with 1.7 billion when stabilization is reached, according to the World Bank projections.[7]

Africa's projected relative growth is again greatest among regions, with an increase of 974 million over its 1.6 billion in 2025 to 2.6 billion in 2100. Some increases projected by the World Bank for African nations are staggering. Nigeria's 100 million population of 1985 is projected to more than triple to 329 million in the 40 years to 2025 and be up to 532 million at stabilization. For Kenya, with a current fertility rate of 8 births per woman, the projection is from 20.6 million in 1985 to 5.8 times that number, 120 million, when stabilization occurs.

Increases projected by the U.N. for other regions with low growth rates or rates declining faster than Asia's or Africa's seem much more modest but are still substantial. Between 2025 and 2100, Latin America will add 459 million to its 2025 population of 779 million and North America (Canada and the U.S.) will add 37 million. These increases reflect only momentum in natural increase and do not incorporate potential large international migration flows. For Europe, the U.S.S.R., Japan, and Oceania combined, the U.N. projects a *decline* of 7 million in this period.

Such enormous future additions to LDC populations may seem impossible, particularly in the poorest countries, given the difficulty that their present economic, social, and political systems have in supporting even current population numbers at decent standards of living. It is tempting to say that the projections are simply too high; that something will happen to slow population growth long before such large increases can occur. Indeed, as noted, fertility is falling in some areas faster than anyone anticipated a decade or two ago.

But even in these areas, population is still increasing and substantial numbers will be added before growth ceases. One of the main lessons from recent demographic history is that the timing of the onset of fertility decline and the pace of that decline once it starts are crucial in determining how population will grow along the path to stabilization. If large numbers accumulate, even low rates will generate large absolute growth along this path. Asia demonstrates this. It is also what makes future prospects for Africa so uncertain. Africa's estimated 583 million population as of mid-1986 is small compared to Asia's some 2.9 billion. But this will not last long at Africa's current overall growth rate of 2.8 percent a year—compared to 1.8 percent in Asia—and higher in many African countries. If such high rates persist for a decade or two, Africa will accumulate a population base capable of generating the large additional numbers that the United Nations projects for the end of the next century, even at the lower growth rates assumed for the early part of that century. That picture will change only if fertility rates decline much faster during the next 10-15 years than suggested in current projections.

The outlook

To complete this overview of world population trends and prospects, it is useful to summarize the two periods of major population expansion since 1750. The first lasted about 200 years and was triggered by rises in population growth rates in Europe beginning during the Industrial Revolution in the late 1700s. It spread overseas to countries of European settlement in the 1800s. World population increased from about 760 million in 1750 to 2.5 billion in 1950, multiplying 3.3 times. Not all this growth occurred in Europe or areas of European settlement. Asia actually added the most numbers of any region because its growth rate, though lower than that of Europe during this period, applied to a much larger initial population base.

The second population surge began after World War II and is concentrated in the developing countries. Their growth rates increased because improved living standards and the introduction of medical technology reduced death rates while birth rates stayed high. Although population growth rates are now slowing in developing regions (except in Africa and a few other areas), the second major population expansion is still going on. Growth rates in industrialized countries are now very low, with fertility in virtually all these countries at or below the replacement level threshold of about two births per woman. Most developing countries still have a way to go before reaching that threshold, though most, except in Africa, are expected to be close to it by 2025. In that year, world population is projected to be 8.2 billion, about 3.3 times the 1950 total. That multiple will have been reached in 75 years, com-

Mothers and children in Francistown, Botswana. Africa's population is projected to grow from 555 million in 1985 to 2.6 billion in 2100.

pared to 200 years in the first major post-1750 population expansion. More than 90 percent of this increase will have been in developing countries, though international migration could affect the actual residential distribution of the increase in population, as it did during the earlier expansion generated in Europe.

How the vast increases projected for developing countries will be accommodated and how they will affect efforts to improve living standards are matters of concern for all nations. For the developing countries, it is a question of whether they will evolve into a kind of permanent underclass at the bottom of a two-tiered world economy. For the more developed countries, now approaching population stabilization and dealing with issues arising from stabilization in advance of the developing countries, it may be difficult to continue as islands of prosperity in a sea of poverty in a world made smaller by modern transportation and communication, particularly if imbalances between population and resources in developing countries generate waves of immigration and other spillovers.

Population Growth and Living Standards

A surge in population does not occur in a vacuum, but as part of sweeping political, economic, and social changes. European population growth accompanied the Industrial Revolution. It was not just a case of more people, but of many more people enjoying living standards that rose along with population numbers. The recent LDC expansion began as political and/or economic colonies of Europe were achieving independence and mounting efforts to haul living standards up the long road to levels in industrialized nations. A key question is whether their rapid population growth retards development.

Theories about population and development

Thomas Malthus, writing at the end of the 18th century, was deeply concerned about the potential adverse effects of England's population expansion. As he looked back over history, much of the evidence he found pointed to periods of population decline after surges of growth. This led him to the pessimistic conclusion that there was a negative feedback between population growth and living standards. A rise in living standards might touch off population growth, mainly through earlier marriage, but diminishing returns to added labor in agriculture with fixed land would eventually lead to economic and demographic downturns.

History proved Malthus wrong, at least for the now-developed countries. The 19th century brought technological and institutional breakthroughs that enabled Europe to avoid the effects of diminishing returns. The newly invented steam engine used energy more efficiently; the factory system increased labor productivity. Trade supplied raw materials for expanding industries and food for urban workers. Growing populations provided labor for industry and markets for new products. Institutional changes that ac-

Table 2. 1980 Population, Gross Domestic Product (GDP), and GDP per Capita: Selected Less and More Developed Countries

Country group	1980 population (millions)	1980 GDP[a] (billions of U.S. dollars)	1980 GDP[a] per capita (U.S. dollars)
Developing countries			
Low-income	2,175	549	250
Middle-income oil importers	611	915	1,500
Middle-income oil exporters	494	654	1,320
Industrial market economies	715	7,463	10,440
Total	3,995	9,581	—

Source: World Bank, *World Development Report 1984* (New York: Oxford University Press, 1984) Table 2.1. Reproduced with permission.

[a]Gross domestic product (GDP) measures the total final output of goods and services produced by an economy.

companied industrialization contributed to the eventual decline of fertility, while emigration eased growing population pressures and helped expand Europe's trade networks. By the end of the 19th century, Malthus and his concerns had been all but forgotten.

The concerns emerged again in the 1950s. Underlying them was the fact that most of the world's income and wealth was in the industrialized countries and most of the population and potential for population growth was in the developing countries. This imbalance continues. Table 2, derived from the *1984 World Development Report* of the World Bank, shows population and gross domestic product (GDP) in 1980 for developing countries classified as low-income and middle-income oil importers or middle-income oil exporters and for "industrial market economies." The contrast between low-income LDCs and industrial market economies is striking. The latter account for only 18 percent of the population covered in the table but 78 percent of the GDP. Low-income LDCs represent 54 percent of the population, but only 6 percent of GDP. The average GDP per capita of industrial countries in 1980, $10,440, was more than 41 times that of low-income LDCs, $250.

Per capita GDP (or income) needs to be interpreted with caution when used to assess differences in living standards. The measure misses the large amount of nonmonetized activity in LDCs and does not reflect important aspects of well-being like health and education. Nevertheless, the differences in per capita GDP in 1980 indicate the challenges involved in reducing the gap between rich and poor nations in the face of the latter's rapid population growth rates, which ranged up to more than 3 percent a year by the 1960s. Developing countries that had experienced little growth in per capita income while population growth rates were low had to accommodate faster growth in numbers just when they were trying to raise average living standards for the populations they already had.

Also of concern was the increasingly youthful age structure of LDC populations as death rates fell rapidly and birth rates remained high. When birth rates are in the 40s per 1,000 population, well over 40 percent of a population is under age 15 (as is true in Africa today). This means both a high potential for future population growth and a high ratio of dependent children to persons in the working ages, 15-64 (see Box 3). The slow economic growth of developing countries before the 1950s had been due to low levels of investment in physical capital (roads, factories, and the like) which could increase their productive capacity. Would not the high ratio of dependent children to producers in high-fertility populations inhibit efforts to increase savings and investment? To many, LDCs seemed trapped by rapid population growth and low levels of economic development.

These concerns were mapped out by U.S. population economists Ansley Coale and Edgar Hoover in their classic 1958 book, *Population Growth and Economic Development in Low-Income*

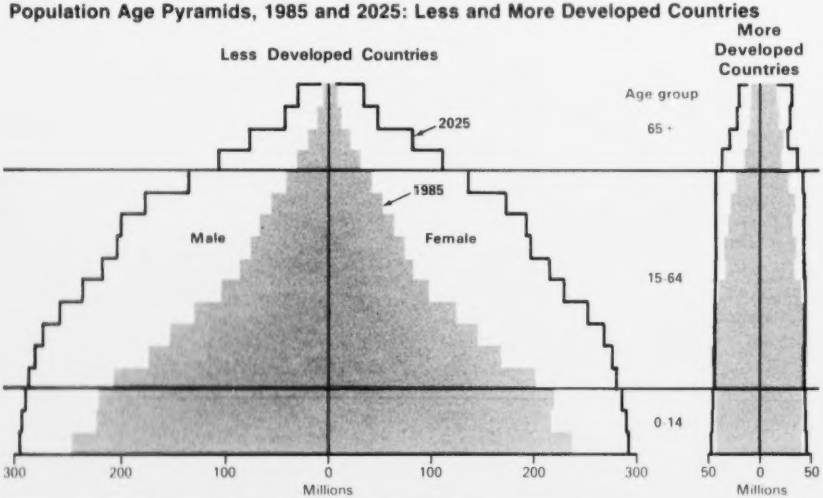
Box 3. Population Age Structure

A population's *age structure* is one of the first features demographers look at when assessing a country's demographic situation. It is the direct result of a country or area's recent demographic history and is closely tied to its social and economic change. Current age structure, which is perhaps the most important part of the story demographers have to tell, is determined by a population's past mortality, migration, and, particularly, fertility and, in turn, strongly influences future demographic patterns.

A glance at the pyramids below tells us much about the history and prospects of the more and less developed countries. Demographic change will be affected by the proportions of the young and old in the population. In the less developed countries as a whole in 1985, reflecting current high fertility, there were about 64 persons under age 15 per 100 persons in the "working ages" of 15-64; the ratio was about half that in the more developed countries. This large "child dependency" ratio can have important socioeconomic consequences for the way in which less developed countries meet the challenges of development.

And, no less significantly, the proportions of young children translate directly into the momentum of future population growth. The far wider base of the LDC population pyramid gives those countries much more potential for population growth. With 37 percent of their population below age 15 in 1985, in contrast to 22 percent in the more developed countries, LDC populations will continue to grow even when LDC couples average two children apiece. The two very different pyramids in 2025 illustrate this dramatically. In the LDCs by 2025, all age groups have become much larger, while the base of the pyramid for more developed countries has begun to constrict. In the more developed countries, the impetus for population growth provided by age structure has all but disappeared.

Population Age Pyramids, 1985 and 2025: Less and More Developed Countries



Source: 1982 assessments of the United Nations, Population Division, medium variant.

Countries.[8] Using computerized economic models and population projections, Coale and Hoover created alternative scenarios for India and Mexico to show how continued high fertility would inhibit growth of per capita income by lowering the amount of investment per worker. Their main policy message was

that if developing countries were to improve living standards, interventions to reduce mortality needed to be balanced by efforts to reduce birth rates.

Neo-Malthusianism, as this view has been called, was the rationale for governments such as the U.S. to channel foreign aid funds to family planning programs in developing countries. Many U.S. legislators were concerned that economic aid efforts would otherwise be swamped by added population. Considerable effort went into informing LDC leadership groups about the adverse effects of rapid population growth to motivate them to support family planning in their countries. In 1984, the World Bank devoted its annual *World Development Report* to the population and development issue. It concluded that: "For the poorest countries, development may not be possible at all, unless slower population growth can be achieved soon."[9]

Not everyone has agreed with the neo-Malthusian view, and the question of how population growth affects development remains controversial. At the 1974 World Population Conference in Bucharest, many LDC delegations challenged the idea that family planning was necessary for development. Nationalistic and Marxian ideologies were reflected in assertions that institutional and structural obstacles rather than population growth cause underdevelopment. However, LDC leaders became much more supportive of family planning in the decade following Bucharest and some countries that had been vocal critics in Bucharest, most notably China, were leading supporters of family planning activities by the time of the next world population conference, which took place in Mexico City in 1984.

Much of the impetus for the Mexico meeting came from LDCs. Ironically, the U.S., whose advocacy of family planning had been challenged in 1974, was the country that went against the mainstream at the 1984 meeting. The U.S. delegation led a movement to exclude abortion from family planning programs and took a position of conservative skepticism regarding the adverse effects of population growth on economic development. It urged LDCs to seek free markets rather than expand government involvement in economic and population matters.[10]

The U.S. stance at the Mexico conference reflected election-year politics as well as growing criticism in the U.S. of the "limits-to-growth" approach to economic-demographic relationships. A number of economists were skeptical of models that produced dire results when projected rises in population were matched against fixed resources and a fixed absorptive capacity of the environment.[11] Following Coale and Hoover, the best known of these models were the original *Limits to Growth* report of the Club of Rome, published in 1972, and the 1980 *Global 2000 Report to the President of the United States*.[12] Limits-to-growth thinking was targeted for criticism by growth optimists such as economist Julian Simon and futurist Herman Kahn.

Simon and Kahn argued that limits models ignore the role of markets in generating adjustments which bring population, resources, and the environment back into balance.[13] They cited evidence that resource prices have fallen rather than risen over the long run and listed the resource-saving (or substituting) inventions that human ingenuity has fashioned in response to imbalances created by population growth. In their optimistic view, population growth is a stimulus, not a deterrent, to economic advance. If imbalances persist, it is because markets are not being allowed to generate the proper signals to innovators, investors, and entrepreneurs through the price system. Simon's widely publicized 1981 book, *The Ultimate Resource*, cast human ingenuity (the "ultimate resource") as the solution to population-resource problems.[14]

This political and academic criticism of neo-Malthusian views has stirred renewed interest in the question of whether and how rapid population growth affects the economic growth of less developed

countries. In 1983 the National Research Council of the U.S. National Academy of Sciences commissioned a panel of experts to review scientific evidence on these issues. The panel's report, *Population Growth and Economic Development: Policy Questions*, published in March 1986, poses nine questions about the theoretical and empirical evidence on links between population and development:[15]

1. Will slower population growth increase the growth rate of per capita income through increasing per capita availability of exhaustible (nonrenewable) resources?
2. Will slower population growth increase the growth rate of per capita income through increasing per capita availability of renewable resources?
3. Will slower population growth alleviate pollution and the degradation of the natural environment?
4. Will slower population growth lead to more capital per worker, thereby increasing per worker output and consumption?
5. Do lower population densities lead to lower per capita incomes via a reduced stimulus to technological innovation and reduced exploitation of scale economies in production and infrastructure?
6. Will slower population growth increase per capita levels of schooling and health?
7. Will slower population growth decrease the degree of inequality in the distribution of income?
8. Will slower population growth facilitate the absorption of workers into the modern economic sector and alleviate problems of urban growth?
9. Can a couple's fertility behavior impose costs on society at large?

In looking for answers to these questions, it is important to note that there are two ways to address the relation between population growth and economic development. One is to ask whether rapid population growth presents an obstacle to development. An affirmative answer does not automatically mean that slower population growth alone would solve development problems, but rather implies that it would make it easier to take the steps needed to promote development. The other way is to ask whether slower population growth itself can speed development, for example, by increasing output per worker.

Both approaches appear in the literature on population and development. The National Research Council experts have posed the issue in the second way. There does not seem to be much difference between the two, since removal of an obstacle to development does contribute indirectly to development. But the second approach requires much stronger evidence to show that slower population growth will actually raise average levels of income, output, schooling, etc.

The panel's answers to their questions are "no" to No. .5 and "yes" to the other eight, but qualified. Summing up, they state:

> "On balance, we reach the *qualitative* conclusion that slower population growth would be beneficial to economic development for most of the developing world." But, they add: "a rigorous *quantitative* assessment of these benefits is context-dependent and difficult."[16] (Italics added.)

This is a more cautious and complex approach than has been typical of popular and policy-oriented discussion of the issue over the last two decades. It is not easy to keep it in focus in a political climate in which debate about funding for international population aid has become heated over such issues as abortion and allegations of coercion by government-sponsored family planning programs.

Population growth and income

Simple arithmetic shows that to maintain a given standard of living, or per capita income, economic growth must equal population growth, and that to *raise* living standards, economic growth must be higher than population growth. The core issue here for the population and development debate is whether and how rapid population growth affects the capacity of a country to raise output and hence per capita income.

Neo-Malthusian theory maintains that raising output is difficult in a rapidly growing population because the youthful age

structure associated with high fertility produces such a high ratio of consumers dependent upon the country's producers. Since consumption and savings are cut from the same pie (annual national income), the argument goes, increased consumption shrinks the amount left over for savings from which investments flow to create a larger pie in the future. However, cross-country studies now suggest that age structure plays at most a secondary role in a country's rate of investment; institutions are more important. In developing countries, the public sector, reinvested profits, and foreign investment influence investment rates much more than personal savings. With the high proportion of poor households characteristic of so many LDCs, there are few households with anything left over for savings. For those in the monetized part of the economy, the "saving" has been done for them by employers who reinvest profits rather than distribute them through higher wages.

Another strand in the neo-Malthusian argument is that with a given rate of investment, a higher rate of population growth leads to a decline in the amount of capital per worker. The World Bank's *1984 World Development Report* calls this "capital widening" in contrast to "capital deepening" when investment per worker goes up. A crucial third variable here is technological change; capital widening will lead to lower productivity (diminishing returns) unless technological change can offset it.

The role of technology is one of the key points on which the population debate is divided. Critics of neo-Malthusianism argue that population growth stimulates technological progress. They cite Europe's experience during the Industrial Revolution and the improvements in agricultural productivity that followed increased demand for food generated by population growth. *Their* critics in turn are less optimistic about the potential of technology to offset capital widening in LDCs today. They point out that few of the technological advances now available to LDCs were developed by LDCs and that many modern technologies in fact exacerbate LDC problems because they are oriented primarily to labor-scarce industrial economics and generate relatively few new jobs. Another problem is that poorer LDCs do not have the financial resources to acquire technologies at world market prices unless they borrow and that some LDCs that have done so are now saddled with crippling debts.

There is little evidence showing that rapid population growth plays a *direct* role in stimulating or inhibiting the technological changes needed to offset capital widening. Again, institutional factors play an important intermediary role, so that the responsiveness of LDCs to their population pressures is conditioned by their specific circumstances.

Thus, it is not surprising that the correlation between population growth rates and per capita income over the past few decades has not been as strong as theoretical models suggest. A further reason for caution about these models is that neither physical output nor the physical capital that generates growth in output tell the whole development story. As noted earlier, measures of physical output such as per capita GDP do not indicate how healthy or educated a population is or who gets what share of the national income. Some LDCs have succeeded in maintaining high rates of economic growth, or output, even with high rates of population growth—for example, Brazil and Mexico until the early 1980s. But this has often been at a high social cost in unequal distribution of income and poor health and inadequate education for the majority of their people.

Education and health

For economic development, investments in human capital through improved health and higher educational attainment are as important, if not more important, than accumulation of physical capital. Healthier, better-educated workers perform better and so boost both a nation's output and their own family living stan-

dards. They are also more likely to respond to population pressures by opting for smaller families and adopting new agricultural methods.

Concern about effects of rapid population growth on investments in education and health focuses on both society and the individual family. Rapid increases in the number of children of school age could defeat national efforts to raise average levels of educational attainment or dilute the quality of education. At the family level, most of the research reviewed in the National Research Council report finds less investment in schooling per child in larger families which, to some extent, seems to reflect deliberate parental trade-offs between family size and per child expenditure.[17] These trade-offs accentuate other social and economic inequalities in LDCs, since lower-income groups tend to have less education and higher fertility than middle- and upper-income groups.

Most LDCs have managed to increase the proportion of children enrolled in school, particularly at the primary level, despite rapid population growth. But government expenditures on education have not gone up at the same pace; the number of pupils per teacher has increased and teachers' salaries have declined, so the quality of education may well have deteriorated.

Average life expectancy has gone up markedly in most LDCs over the past three decades, but this is not clearly linked with government expenditures on health services. Most LDCs have spent the large part of health budgets on hospital-based curative services in cities that are most accessible to middle- and upper-income groups, leaving the urban and rural poor with little health care.

At the family level, one of the most important links between population and health is that between child-spacing and maternal and child health. Data from the World Fertility Survey and Contraceptive Prevalence Surveys show that illness and deaths are more likely among children when births are closely spaced than when births are separated by at least two years.[18] There is also evidence that maternal health is adversely affected when births are closely spaced, so that family planning can improve the health of both mothers and children.

Most LDCs have managed to increase the proportion of children enrolled in school, but government spending on education has risen more slowly, so educational quality may have deteriorated.

Urbanization, employment, income distribution

Historically, urbanization has played an important role in economic development. Cities have been the centers of manufacturing and service industries that produce higher profits than farming, fishing, and the like, so they made it possible for economies to grow along with populations. But urbanization in LDCs has also had many negative aspects. Rapid city growth has generated congestion, deteriorating services, shanty towns, and employment problems and government economic and fiscal policies have often favored urban

Table 3. Proportion Urban and Urban Population Growth Rate: More Developed Countries, 1875-1900, and Less Developed Countries, 1950-1975

Region	Percent of total population in urban areas		Increase in period	
			Number (millions)	Annual rate (percent)
	1875	**1900**	**1875-1900**	
More developed countries	17.2	26.1	75	2.8
	1950	**1975**	**1950-1975**	
Less developed countries	17.3	27.1	520	4.1

Sources: More developed countries 1875-1900: United Nations, *Patterns of Urban and Rural Population Growth* (New York: 1980); Less developed countries 1950-1975: United Nations, *Estimates and Projections of Urban, Rural and City Populations, 1950-2025: The 1982 Assessment* (New York: 1985). See reference No. 19.

dwellers at the expense of rural people and agricultural development.

In assessing the role of rapid population growth in urban problems, it is important to distinguish between urbanization (the proportion of national population living in urban areas) and urban growth (the rate of growth of urban populations). Urbanization increased during the economic and demographic expansions of both European populations during the 19th century and LDCs in this century. A comparison shows that the rise from 1950 to 1975 in the urban proportion of LDC populations, 17 to 27 percent, was similar to the rise from 1875 to 1900 in the now-developed countries, 17 to 26 percent. This suggests that development rather than population growth is the main determinant of urbanization.[19] But LDC city population grew by 4.1 percent a year between 1950 and 1975, far faster than the average 2.8 percent annual growth rate of city population in the now-developed countries from 1875 to 1900 (see Table 3). This is because city growth rates reflect national population growth rates, and national rates have been so much higher in LDCs than they ever were in the developed countries.

According to the United Nations, natural increase accounts for about 60 percent of the growth of LDC city populations, with "primate" cities, usually national capitals, growing more rapidly than smaller cities.[20] Rural-to-urban migration accounts for the remaining growth. Indirectly, natural increase also figures into the contribution of migration, since higher natural increase in rural areas is one of the factors in migration to cities. Other important factors are limited job opportunities and services in rural areas and the much better opportunities that potential migrants perceive to be waiting in urban areas. Improved transportation and communication have also fostered geographic mobility in LDCs.

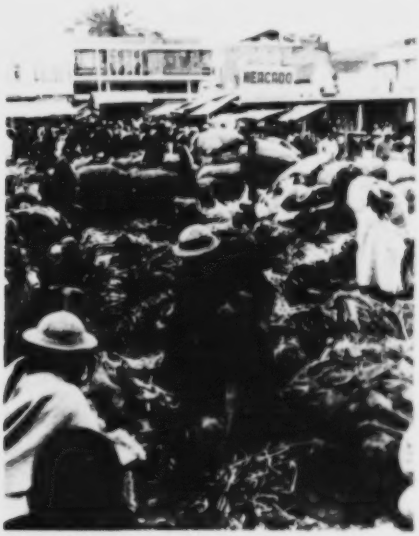
The rapid growth of LDC cities presents many challenges, including pressures on services—education, health, water, sanitation, and transport—and, perhaps greatest of all, on employment.[21] Most LDCs have opted for a style of industrialization oriented to products requiring modern and labor-saving technologies in order to meet foreign competition for local as well as export markets. These industries have not created jobs as fast as job-seekers have arrived in cities. One consequence of this is increasing segmentation of urban labor markets, with higher pay but more limited access to jobs in the more organized segment of the market and lower earnings in the "informal" sector—personal and domestic services, crafts production, street vending, and the like.

The informal sector is an important way that LDC city dwellers cope with the employment problem. In fact, it is often the only means for survival in societies that cannot afford public welfare. But it is also a prime reason for the persistence in cities of the income inequality that has traditionally divided urban and rural areas. A growing concern of many observers is the prospect of a large and semi-permanent underclass of urban poor who have little hope of increasing their earnings and also lack access to basic services, because water, sanitation, and public transportation to reach schools, health facilities, and jobs are of-

ten not supplied to the unplanned shanty towns where up to half of LDC city residents live.

Links between population growth and income inequality are complex because so many variables are involved. It is tempting to resort to the maxim that "the poor have children" and let it go at that. In most countries, fertility rates are indeed higher among lower-income groups in both urban and rural areas. Family planning programs that offer easy access to otherwise unaffordable contraceptives can improve the welfare of the poor. However, as the National Research Council report notes, it is more difficult to illustrate conclusively that lower fertility would narrow income inequalities over the long run.[22]

Rapid population growth cannot alone be blamed for the problems of LDC cities which are fundamentally due to inadequate economic, social, and political structures and policies. But it aggravates the problems and a basic fact is that about 80 percent of total LDC population growth over the past three decades has been absorbed by cities and the proportion is likely to be higher in the coming decades. Further, even though population growth rates are declining in most LDCs, young adult populations are growing especially rapidly, because of past high fertility, and this will continue well into the next century. This puts extra pressure on city job markets and housing for new families. Slower urban growth will ease the problems eventually. But the slower city growth that is projected for early in the next century depends very much on how rapid the projected continuing decline in LDC national population growth rates will be.



A market in Ecuador. The informal sector is an important way that LDC city dwellers cope with the employment problem.

Population, resources, and the environment

The impact of rapid population growth on resources and the environment concerns both developed and developing countries, but is specially important in the prospects for economic development in LDCs. Limits-to-growth theorists argue that the escape from Malthusian diminishing returns was only temporary and that planet earth is faced ultimately with fixed supplies of resources. Further, the technological "fixes" invented to stave off humanity's arrival at these limits are creating major environmental problems: air and water pollution from intensified manufacturing and farming, loss of topsoil, depletion of groundwater reserves, etc. For now, the consumption patterns of high-income countries have more impact on resource supplies and the environment than the large numbers of people in low-income countries. But computer models go into tailspins when they incorporate the prospect of even larger numbers in LDCs striving to emulate these consumption patterns in the future. The limits debate involves the issue of equity between generations as well as between rich and poor nations; conservation to ensure the availability of resources and a healthy environment for future generations requires reduced con-

sumption by present generations. Low-income populations are averse to the idea of limiting their already limited consumption for the benefit of future generations of better-off individuals.

Important in looking at the impact of population growth on resource supplies is the difference between nonrenewable resources—fossil fuels and minerals—and renewable resources, such as water, farmland, forests, and fisheries. Since the earth's supply of nonrenewable resources is fixed, the human race has to find alternatives sooner or later. Population growth affects how soon these resources will run out but not the fact that they ultimately will.

Market forces play an important role in regulating the conservation and depletion of nonrenewable resources as well as stimulating development of substitutes for minerals and fossil fuel energy (oil, natural gas, and coal). With new and better mining methods and more recycling, the prices of many minerals have actually fallen in real terms over the past half century and more. Slowing population growth can "buy time" for the development of such technologies. The National Research Council report finds that most evidence on the links between population growth and depletion of nonrenewable resources shows that consumption patterns and production techniques are more important than population growth, at least on a global scale. This is scant consolation for low-income countries who are already short of resources and must buy oil and minerals at world market prices and are also under pressure from their rapid population growth. For them, the chance to buy time to accommodate increased numbers can be crucial for the welfare of future generations.

Renewable resources, on the other hand, can be reused indefinitely as inputs to production so long as they are not exploited past the point of regeneration. As the basis for food production, agricultural land, forests, and fisheries are especially important renewable resources for LDCs with rapidly growing populations. Population growth can affect the use and regeneration of these resources in two ways. One is the issue that concerned Malthus, diminishing returns. With a fixed stock of resources like arable land, added labor yields smaller and smaller increases in output per worker until the point when adding more workers becomes counterproductive and total output actually declines. Added workers and demands generated by population growth can also lead to overgrazing of rangelands, for example, and overharvesting of fisheries and forests that reduce or totally destroy the capacity of these resources to regenerate.

Malthus' predictions of declining labor productivity in food production did not materialize because of increased use of fertilizers and irrigation, development of new seed varieties, and other improvements in farming techniques as well as expansion of the amount of arable land under cultivation. Before 1950 most increases in world agricultural production stemmed from expansion of cultivated land. Since then, application of technology to increase yields per unit of cultivated land has played the larger role. Japan is a classic example of a country that overcame diminishing returns on its very limited arable land through intensive cultivation methods. The NRC report notes that Latin America and parts of Africa still have arable land that could be cultivated but also cites examples of diminishing returns in crowded Bangladesh and in sub-Saharan Africa. The latter has often gone hand in hand with soil degradation and deforestation, for which there is evidence of a link with climatic changes, especially reduced rainfall.[23]

Current global estimates of recent and projected food production are much more optimistic than those made during the world energy crisis in the mid-1970s. According to the United Nations Food and Agriculture Organization (FAO), world agricultural output rose 25 percent between 1971 and 1982, with production in LDCs rising 33 percent, compared to 18

Table 4. Population-Supporting Capacity in 2000 of 117 Less Developed Countries with All Cultivable Land Used for Food Crops, by Region

Level of farming	Number of countries in region					
	Africa	Southwest Asia (Middle East)	South America	Central America	Southeast Asia	Total
Total countries	51	16	13	21	16	117
	Unable to feed 2000 population on a sustained basis with:					
Subsistence-level farming	29	15	—	14	6	64
Intermediate-level farming	12	15	—	7	2	36
High-level farming	4	12	—	2	1	19

Source: G. M. Higgins et al., *Potential Population-Supporting Capacities of Lands in the Developing World*, Technical Report of Land Resources for Populations of the Future Project, by United Nations Food and Agriculture Organization (FAO), with the International Institute for Applied Systems and Analysis and United Nations Fund for Population Activities (Rome: FAO, 1982) p. 49.

Subsistence-level farming = No fertilizers or chemicals; traditional seed varieties and cropping patterns; no conservation measures.
Intermediate-level farming = Basic fertilizers and chemicals; some improved seed varieties; simple conservation measures; most productive crop mix on half of land.
High-level farming = Full mechanization; optimum use of fertilizers, chemicals, seed varieties, and conservation measures; ideal mix of crops on all land.

percent in developed countries.[24] Per capita food production went up 16 percent in South America and 10 percent in Asia during that time. Sub-Saharan Africa, where per capita food production has fallen since 1970, is the exception to this trend, although there, too, successful field trials of new grain varieties and better pest-control and farming methods are hopeful signs of change.

The main constraints on future world food production are likely to be political, managerial, and financial rather than technical. Bad management and misallocation of resources are cited, along with drought, as the main causes of famine in Africa, exacerbated by the region's rapid population growth. Technologies to increase food output exist, although they must be monitored to avoid degradation of soil and the environment. Also, the poorest LDCs with the greatest food needs may not have the financial resources and management skills to put more productive agricultural technology to work. The FAO recently weighed the food production potential of 117 LDCs against projected population in 2000, at different levels of technology and assuming that all cultivable land is used for food crops. The results, shown in Table 4, indicate that with only traditional subsistence farming methods, 64 of the 117 countries would be unable to feed their projected populations in 2000; 36 would still not be self-sufficient in food at intermediate levels of farming (some use of fertilizers, chemicals, improved seed varieties, and simple conservation measures); but the total drops to just 19 if the most advanced farming technologies are used (roughly those used in the U.S.). Those countries that cannot feed their own populations must somehow generate enough foreign exchange outside of agriculture to be able to pay for food imports, or face continuing reliance on food aid.

Conservation or depletion of renewable resources is affected by institutional arrangements—whether the resources are privately owned or open to all, and whether or not properly managed. Land, for example, will regenerate itself from season to season if ownership can be established and utilization controlled. This assumes, of course, that conservation measures are practiced; individual owners may adopt practices that lead to soil erosion and degradation if their main interest is short-term gain rather than preservation of resources over the long run.

With resources open to all—fishing grounds, forests, and agricultural land held in common—the door is open for

individual users to exploit the resources for private short-term gain at a pace that could eventually destroy the resource as users multiply and if all do the same. In much of sub-Saharan Africa, land is abundant relative to labor, but common-use systems along with growing populations have accelerated the degradation of soil, grazing lands, and forests. The common-property problem also arises with pollution of the environment, threatening resources like air and water, and with the preservation of genetic diversity among animals and plants. Efforts to develop and diffuse high-yielding seed varieties bring major short-term gains, but this can lead to genetic uniformity of crops and bring on disaster if disease strikes a variety of crop that farmers grow exclusively.

Even though it is in everyone's interest to preserve common-property resources, growing numbers of users coupled with individual efforts to get the maxim return can lead to their eventual destruction. This potential "tragedy of the commons" was first pointed out by ecologist Garrett Hardin in a famous 1968 essay, using a parable about herdsmen, their cattle, and their eventual destruction of a common pasture and the cattle's deaths to argue that humans must abandon the "freedom to breed."[25] The only way to avoid the tragedy with a common-property resource is to establish property rights or, if that is not possible, to set up agreements or laws to regulate use of the resource. Institutionalization of a system for proper management of a common resource may be difficult, however, when this is seen as favoring one group over another. For example, many Brazilians regard exploitation of their Amazonian rainforests as a way of catching up to wealthier nations and resent outsiders who insist that the forests must be preserved because of their importance to the world's climate and stock of species.

Problems associated with the preservation of common resources are part of a larger set of issues that economists call "externalities." Externalities arise when the costs or benefits of one individual's actions fall on other individuals or on society as a whole. When costs or benefits are shifted from individual to individual, there is a redistribution of wealth or welfare. When the shift is from individual to society, the net result in the case of common resources can be destruction of the resource if individual actions are left unregulated.

Childbearing also involves externalities, costs that parents do not have to pay. These include public services—education, health programs—and the costs of increased numbers in a population—congestion and the like, and potential declines in wages when labor forces grow too large. These costs can be "internalized" with incentives or disincentives that bring individual couples' childbearing actions more in line with the costs to society. But this goes beyond economics to the value systems of society. Societies and individuals differ widely in the perceived and actual value of children, and what might be acceptable in one society—required fees for all schooling, no tax breaks for third and later children—might not be in another. Where fertility is considered too high, a minimum incentive on which virtually all would agree is provision of subsidized family planning services that would allow couples to have no more children than they want. Giving couples this control benefits both individual families and societies.

Population and Economic Development: A New Consensus?

The reexamination of relations between population growth and economic development should leave us a good deal more cautious about broad generalizations that blame rapid population growth for all development problems. To the extent that neo-Malthusianism has

exaggerated the direct link between population growth and development, criticism is justified. But there is need for a balance in this criticism: rapid population growth is not the root cause of underdevelopment, but it cannot be ignored in dealing with the complex problems facing developing countries.

Probably the most important lesson learned from continued study of the relationships between population and development is the key role of institutions in mediating these relationships. Common to many developing countries, though they vary in severity, are institutional obstacles to development like unequal distribution of wealth and political power, poor management and organization, and waste of resources on military activities. Rapid population growth exacerbates many of the resulting problems but slowing population growth will not remedy the situation without positive steps toward change. Some commentators have characterized rapid population growth as the "accomplice" rather than the "villain" in this story.[26] They also note that the story has many variants, depending on economic and political situations in different LDCs.

The optimism of those who criticize limits-to-growth thinking is based on the assumption that institutional barriers will fall away so market forces can have full play. But this is questionable in light of economic and political realities in both developing and developed countries. Getting the right set of relative prices needed to generate technical and social responses that will conserve resources and preserve the environment as population grows depends on the distribution of economic and political power within and between countries. That arriving at the right prices on a worldwide basis will not be easy is suggested by evidence of interest groups in more developed countries like the U.S. who manipulate markets for purposes far removed from safeguarding of resources and the environment.

For developing countries, the issue is complicated by their limited share in the world's wealth compared to their share of the population. Poor and debt-burdened LDCs may not be able or willing to pay the prices that are right in market terms in order to balance resources and environmental preservation with population. When governments control resource and environmental decisions, leaders concerned with political self-preservation may be tempted to set food and resource prices artificially low in order to placate their growing populations. Individuals, too, mired in the poverty typical of so much of the developing world, are more interested in self-survival than preservation of common resources, particularly if that preservation is seen as maintaining the consumption patterns of individuals with higher incomes. And in both developing and developed countries, some common resources like air and water are difficult to control through market forces.

In sum, it is a lot harder to tell the development story more accurately as the complex interplay of population and institutional factors than it is to construct computerized economic-demographic models. It is also more difficult to establish rigorous scientific proof of the adverse effects of rapid population growth when development is understood in this way, because the story is still unfolding. This leaves policymakers with a dilemma. If they wait for sure proof of the adverse effects of rapid population growth, it may be too late to stop such effects from playing themselves out.

While the "doomsday" predictions of a decade or so ago now seem simplistic and exaggerated, not even population growth optimists envisage a world in which population can increase indefinitely. The real issue is whether there should be interventions to bring down high population growth rates in LDCs where such rates appear to be contributing to underdevelopment. More and more LDC leaders view these interventions as a matter of good judgment and common sense, even if not yet fully warranted on quantitative scientific

grounds. Developed countries have basically relied on the same sort of judgment in providing population assistance over the past two decades. With the new population debate, they have learned to be more careful in explaining their rationale for this aid, particularly to political and media audiences who are prone to overstatement.

Fertility Decline in LDCs

Because they generally occur at a glacially slow pace, demographic changes rarely make the headlines. Yet the decline of a third or more in the fertility rates of many LDCs between the early 1960s and the early 1980s is headline news. According to the broad estimates shown in Table 5, total fertility rates have fallen substantially for several Asian countries and for many in Latin America, with China's drop from a total fertility rate of 5.8 births per woman in 1970 to 2.1 in 1984 being the most dramatic and demographically most important because of China's first-place population size. Even second-place India has experienced some decline, from an estimated 5.8 in the early 1960s to 4.5 in the early 1980s. However, fertility rates are still well over 6 births per woman in almost all countries of Africa, and in Afghanistan, Bangladesh, Nepal and some other smaller South Asian countries, and not much lower in Guatemala and other countries of Central America.

In response to concerns about the adverse effects of rapid population growth on development, international assistance to LDC family planning programs increased substantially during the late 1960s and 1970s. Prior to the mid-1960s, most population aid came from private foundations. After 1965 official U.S. aid grew, and the U.S. was the major donor by the mid-1970s.

An important assumption of the aid effort was that interventions to reduce fertility would be as effective as those made

Table 5. Fertility Change in Less Developed Countries, Early 1960s to Early 1980s: Selected Regions and Countries

Region or country	Total fertility rate		Percent change
	Early 1960s[a]	Early 1980s	
East Asia	5.3	2.3[b]	−56.6
China	5.9	2.1[b]	−64.4
South Asia	6.1	4.6[a]	−24.6
Afghanistan	7.0	6.5[b]	−7.1
Bangladesh	6.7	6.2[b]	−7.5
India	5.8	4.5[b]	−22.4
Nepal	5.9	6.3[b]	+6.8
Thailand	6.4	3.5[b]	−45.3
Africa	6.7	6.4[a]	−4.5
Egypt	7.1	5.3[b]	−25.4
Kenya	8.2	8.0[b]	−2.4
Nigeria	6.9	6.3[b]	−8.7
Latin America	5.9	4.1[a]	−30.5
Brazil	6.2	4.1[b]	−34.4
Guatemala	6.8	5.8[b]	−14.7
Mexico	6.7	4.4[b]	−34.3

Total fertility rate = Average number of lifetime births per woman at current age-specific fertility rates.

[a]Source: United Nations, Population Division, *Demographic Indicators by Countries as Assessed in 1984*, medium variant, New York, December 1985, computer printout, for 1960-65 ("early 1960s") or 1980-85 ("early 1980s").
[b]Source: Population Reference Bureau, *1986 World Population Data Sheet* (Washington, D.C.: 1986).

to reduce mortality. Many were skeptical, however, that LDC families would be as willing to limit births as they were to avoid premature death, with the prevailing view that large numbers of children are necessary for labor in family enterprises, parental security in old age, and as a hedge against child mortality. Other observers, noting that fertility fell in Europe without benefit of organized family planning programs, argued that funds might be better spent on development goals like education and health programs to reduce child mortality that would enhance the motivation for smaller families. This view was summed up in the slogan of some LDCs reacting against population aid donors at the 1974 Bucharest population conference: "Development is the best contraceptive."

Donor agencies responded to this challenge by funding major research ef-

forts to increase understanding of reproductive behavior in LDCs and to measure the impact of family planning programs. The World Fertility Survey, conducted from 1974 to 1984 in 42 LDCs, and a series of country studies sponsored by the U.S. National Academy of Sciences were important in this effort.[27] The agencies also sought to identify how family planning and other development efforts complement each other and to incorporate these influences in the programs they supported.

The World Fertility Survey was designed according to the intermediate variables framework developed two decades earlier by demographers Kingsley Davis and Judith Blake.[28] This framework shows how social and economic variables—education, employment, religion, etc.—affect fertility through their effect on intermediate variables related to the physiology of reproduction—intercourse, conception, and pregnancy outcome (miscarriage, abortion, or a live birth).[29] Population Council researcher John Bongaarts refined the intermediate variables into four "proximate determinants" of fertility: marriage, temporary infecundity associated with breastfeeding after childbirth, contraception (including sterilization), and abortion.[30] He devised methodology to measure the contribution of each to fertility decline or to differences between the actual total fertility rate of a population and the theoretical "natural" fertility rate of 17 births per woman.

Marriage differentials

The earlier women marry and the higher the proportion of women who ever marry, the greater the "exposure" of a population to the risk of childbearing, assuming that most births occur to married women or women in unions comparable to marriage. Earlier and much more universal marriage explains why birth rates in LDCs before recent declines were much higher than they were in Europe at the start of the fertility transition there. By the 1970s, marriage patterns varied widely in LDCs, according to World Fertility Survey findings. The proportion of women aged 15-19 who were married or living in consensual unions was close to 50 percent in South Asia and sub-Saharan Africa, about a quarter in the Middle East and North Africa, less than 20 percent in Latin America and East Asia, and only 5 percent in Korea and Hong Kong. The average age at marriage varied from 16 in Bangladesh to 25 in Sri Lanka, which largely explains the 2.3-child difference in these countries' total fertility rates around 1975: 6.0 births per woman in Bangladesh and 3.7 in Sri Lanka.

Parentally arranged child marriages, still common in parts of South Asia, contribute to higher fertility. Increased education and job opportunities help increase age at marriage and reduce fertility. Efforts to raise age at marriage by legislation have not been particularly successful. China attempted to raise the marriage age by edict in the 1960s and 1970s but later relaxed the policy in response to social pressures.

In Korea,. higher age at marriage accounted for about as much of the drop in the fertility rate from 6.1 to 4.0 births per woman between 1960 and 1970 as did increased use of contraception (see Figure 3). The contribution of higher age at marriage to recent fertility declines has been less, though still significant, in India and Indonesia, but much less in Thailand, as in Latin America, where average age at marriage was higher to begin with.

Breastfeeding

Breastfeeding lengthens a woman's period of natural infertility after a birth and thus can increase the interval before the next pregnancy and reduce completed family size, even if no contraception is used. In Bangladesh, Pakistan, Nepal, and most of sub-Saharan Africa, where very few women use contraception, prolonged breastfeeding has kept fertility rates from being even higher than they are. In Latin America, however, breastfeeding declined as urbanization

increased in the 1960s and 1970s and without offsetting increases in contraceptive use, fertility would have risen rather than fallen.

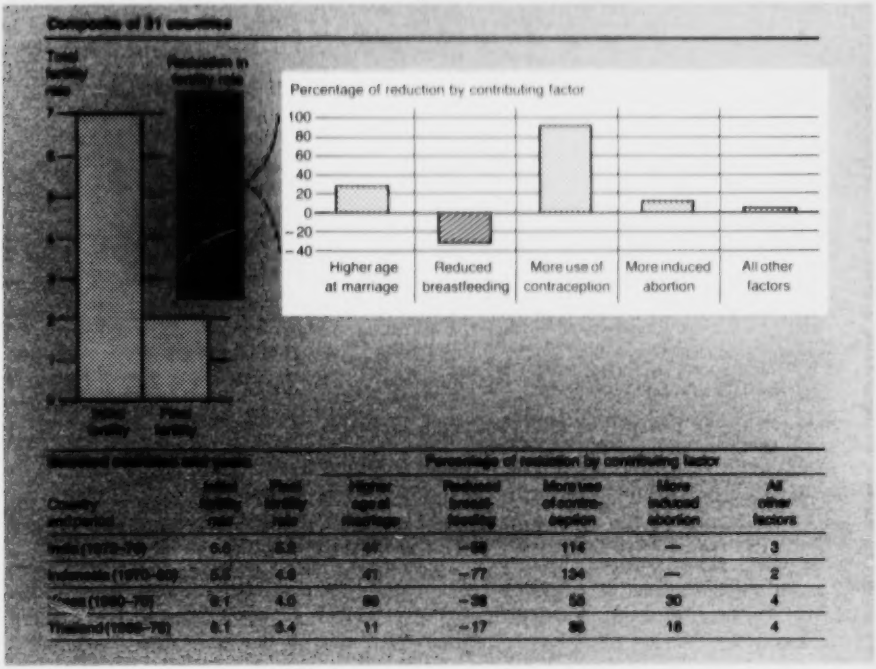
Abortion

Induced abortion has lowered fertility in LDCs but by how much is hard to say, since even in the many countries where abortion is legal to varying degrees, women are reluctant to admit in surveys that they have had an abortion. In Cuba and Korea, where it has been measured, abortion has contributed to fertility decline.

Rising contraceptive use

As shown in Figure 3, increased contraceptive use has been by far the most important of the four "proximate determinants" in recent reductions in LDC fertility rates, accounting for some 90 percent of the average decline in 31 countries. (Note that the sum of the effects of proximate determinants on the fertility decline comes to more than 100 percent because of the need to offset the negative effect of reduced breastfeeding.) During the 1970s, the proportion of women of reproductive age using contraception increased dramatically in East Asia, from 15-25 percent to 55-60 percent in Korea and Thailand, for example, and also went up markedly in several Latin American countries, including Brazil, Colombia, and Mexico. Where contraceptive prevalence remained very low—Bangladesh, Nepal, Pakistan, for

Figure 3. Contribution of Proximate Determinants to Fertility Decline: Selected Less Developed Countries



Source: World Bank, *World Development Report 1984*, Figure 6.5. Reproduced with permission.

Table 6. Recent Contraceptive Prevalence Rates and Total Fertility Rates in 46 Less Developed Countries and 17 More Developed Countries

Region, country and year of survey	Percent of currently married women 15-44 using contraception	TFR[a] at time of survey
Less Developed Countries		
Sub-Saharan Africa		
Benin 1981-82	20	7.1
Botswana 1984	29	5.8
Cameroon 1978	3	6.4
Ghana 1979-80	10	6.5
Ivory Coast 1980-81	3	7.4
Kenya 1977-78	7	8.3
Lesotho 1977	5	5.8
Mauritania 1979	1	6.3
Nigeria 1981-82	5	6.3
Senegal 1978	4	7.2
Sudan (north) 1978-79	5	6.0
Zimbabwe 1984	38	6.5
Asia and Pacific		
Bangladesh 1979-80	13	6.2
Fiji 1974	42	4.2
Indonesia (Java Bali) 1976 [b]	28	4.7
Korea, South 1979	55	2.6
Malaysia (peninsular) 1974	35	4.7
Nepal 1981	7	5.9
Pakistan 1975	5	6.3
Philippines 1978	39	5.2
Sri Lanka 1982	57	3.7
Thailand 1981	59	3.9
Latin America		
Barbados 1980-81	47	2.4
Bolivia 1983	26	8.6
Colombia 1980	51	3.6
Costa Rica 1981	66	3.6
Dominican Republic 1983	47	4.1
Ecuador 1979	35	5.3
El Salvador 1978	34	6.3
Guatemala 1983	25	5.8
Guyana 1975	35	5.0
Haiti 1983	7	5.9
Honduras 1981	27	6.5
Jamaica 1983	52	3.5
Mexico 1979	40	4.6
Panama 1979-80	61	3.9
Paraguay 1979	39	5.0
Peru 1981	48	5.2
Trinidad and Tobago 1977	55	3.3
Venezuela 1977	49	4.5
Middle East and North Africa		
Egypt 1980	25	5.3
Jordan 1983	26	6.6
Morocco 1983-84	27	5.9
Syria 1978	20	7.5
Tunisia 1983	42	7.0
Yemen Arab Republic 1979	1	8.5
More Developed Countries		
Europe		
Belgium (Flemish) 1975-76	85	1.6
Bulgaria 1976	76	2.1
Denmark 1975	63	1.5
Finland 1977	80	1.6
France 1977-78	71	1.8
Hungary 1977	74[b]	2.0
Italy 1979	78	1.6
Netherlands 1982	78[c]	1.4
Norway 1977-78	71	1.7
Poland 1977	75	2.3
Portugal 1979-80	70	2.3
Romania 1978	58	2.4
Spain 1977	51	2.2
Switzerland 1980	70	1.9
United Kingdom 1976	77	1.8
Yugoslavia 1976	55	2.0
United States 1982-83	68	1.8

[a]TFR = Total fertility rate = Average number of lifetime births per woman at current age-specific fertility rates.
[b]Data are for all women under age 40.
[c]Data are for women born 1945-64 and include cohabiting women.

Source: Kathy A. London et al., "Fertility and Family Planning Surveys: An Update," *Population Reports*, Series M, No. 8 (Baltimore: Population Information Program, Johns Hopkins University, September-October 1985) Tables 4, 5, and 12.

example, and in sub-Saharan Africa—there was also no fertility decline.

Table 6, from a late 1985 report of the Population Information Program of Johns Hopkins University, shows the latest known contraceptive prevalence rates from World Fertility Surveys or Contraceptive Prevalence Surveys in 46 LDCs, along with the total fertility rate at the time of the survey, and contraceptive prevalence rates from similar recent surveys in 17 more developed countries, with the 1982 total fertility rates in these countries. The association between these rates is striking. Among the more developed countries, the proportion of married women using contraception is well over 60 percent except in Romania, Spain, and Yugoslavia, and the total fertility rate in 1982 was above the replacement level of 2.1 births per woman only in Poland, Portugal, Romania, and Spain,

Among the less developed regions, contraceptive prevalence is highest in Latin America, ranging up to 66 percent in Costa Rica, in 1981, where the total fertility rate was then 3.6. In sub-Saharan Africa, contraceptive prevalence was as high as 38 percent in Zimbabwe, in 1984, though fertility was still estimated at 6.5 births per woman, but the proportion of married women using contraception was 10 percent or lower in almost all the sub-Saharan African countries surveyed, and the fertility rate was below 6 only in Botswana, in 1984, and in Lesotho, in 1977.

Explaining contraceptive prevalence

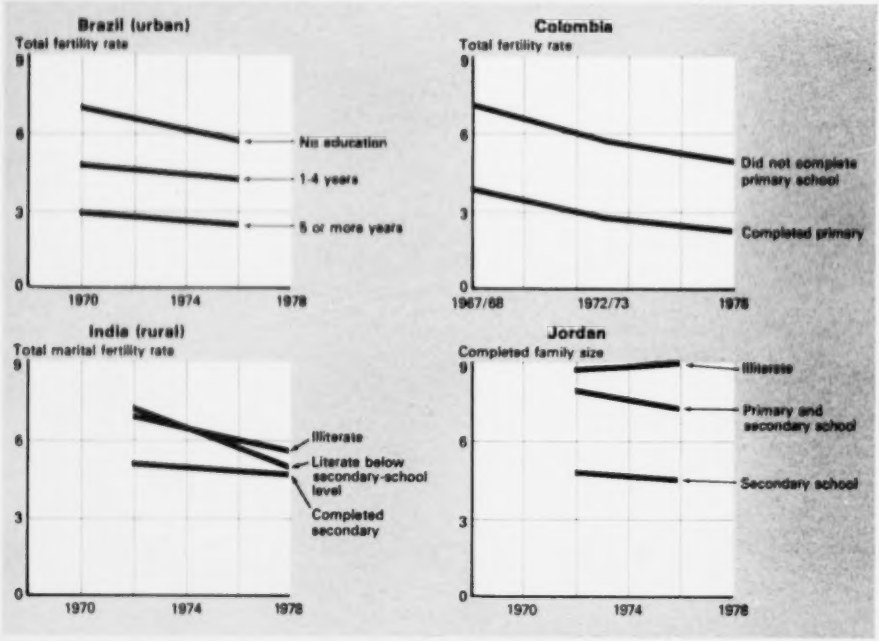
Easier access to contraceptives and increased motivation for smaller families explain most of the rise in contraceptive use in LDCs and, hence, fertility declines, where these have occurred.

Depending on the method they use, couples require some mix of information, medical assistance, and supplies in order to control fertility. Family planning services are supplied through private physicians, pharmacies and other commercial outlets, private or publicly organized family planning programs, and/or incorporation of family planning into existing health service programs. Increased spending on family planning by LDC governments themselves and foreign donors has increased the flow of contraceptive supplies and services to LDC populations, improved the effectiveness of delivery systems, and promoted research on more effective and culturally acceptable contraceptive methods.[31] By 1980 annual public spending on family planning activities in all LDCs amounted to some $2 billion, according to World Bank estimates.[32] LDC governments themselves accounted for practically all this spending in China and about 80 percent in India. In all other LDCs combined, foreign donors accounted for about half of the spending, with the amount varying from about 90 percent in countries with programs less than five years old to well under half in countries with programs at least ten years old. In the early 1980s, international population aid added up to about $500 million a year, or a quarter of public spending on family planning in LDCs. This was about 1.9 percent of the total foreign aid budget of Western European countries, Japan, Canada, and the U.S. The U.S. government and private American foundations currently provide about 40 percent of all foreign aid for population, but the U.S.'s contribution fell in real terms during the 1970s. The U.S. government appropriation for population aid in fiscal year 1986 (October 1, 1985, through September 30, 1986) was $239 million.

Use of contraception depends in turn on the motivation of couples to space or limit births, sometimes—as in sub-Saharan Africa today—mainly in order to improve the health of mothers and their children, but more often as a conscious effort to achieve social and economic aspirations associated with smaller families. Research now shows that the links between social and economic development and fertility control are complex and vary according to culture and other variables that are difficult to quantify. Even for Europe's fertility transition, simpler explanations of the decline as a consequence of urbanization and industrialization have given way to more complex models that take account of the fertility-decision process at the family level in different socioeconomic settings, the role of language and culture in the diffusion of the idea of fertility control, relationships between different generations in families and the sociocultural institutions that govern them, and the interplay between fertility and the two other demographic variables—mortality and migration.

Factors that change the traditional roles of women and improve their status are among the most important in explaining shifts to the small-family norm. Of these, increased education is consistently one of the most powerful variables explaining lower fertility and fertility

Figure 4. Fertility Decline, by Women's Education: Brazil, Colombia, India, Jordan



Source: World Bank, *World Development Report 1984*, Figure 6.6. Reproduced with permission.

declines, as seen in the data for Brazil, Colombia, India, and Jordan in Figure 4. Education can open the door to employment opportunities outside the home, change women's aspirations, and increase their chances of knowing how to control fertility and to take better care of children so that fewer births are needed to achieve a given family size. Economic theories of fertility decline add that education increases the value of women's time, leading to the substitution of other activities—including work outside the home—for the time-intensive one of raising children.

Education also plays a role in the changing balance of intergenerational costs and benefits that appears to accompany the shift to a small-family norm. Australian demographer John Caldwell points out that this shift occurs when parents begin to invest more in their children, mainly through increased schooling, than children contribute to the family through child labor, care for aged parents, and other traditional benefits of large families.[33] This reversal in the intergenerational "flow of wealth," which encourages couples to opt for smaller families, occurs in response to such changes as shifts from the extended family to the nuclear family as the basic economic unit, increasing urbanization and industrialization, and rising family incomes.

This helps explain why rising income is associated with smaller families rather than with larger families, which one might expect because most families want children and with higher incomes they could

afford more. But once parents have more money to "invest" in children's education, for example, they tend to choose quality over quantity—fewer children but more spent on schooling per child, rather than spreading resources more thinly over many.

Child survival is another variable associated with rising income and reduced fertility. In low-income populations with high fertility and mortality, high proportions of children die before reaching adulthood. Parents who want children for family labor and security in old age often anticipate the loss of children by having more than would be needed if all survived. As living standards improve, more children do in fact survive. Increased fertility control both helps parents adjust their reproductive behavior to increased child survival and, conversely, as noted earlier, it increases the chances of child survival by making it possible to space births at least two years apart.

Widespread conscious action by couples to limit their fertility is a modern innovation. Preindustrial societies evidently know of ways that will actually control fertility (abstinence, withdrawal, abortion), but high average levels of fertility clearly indicate that practice is limited in such societies. Just how the idea and practice of fertility control spread through societies is a question that continues to fascinate social scientists. In Europe and European settlements overseas in the 19th century, this diffusion appeared to follow cultural and linguistic lines, suggesting that word-of-mouth was the main channel.[34] In LDCs today, mass media—radio, TV, film, print—have exploded and may be very important in accelerating the spread of the small-family norm and the knowledge that something can be done to achieve it. Communication is a major function of organized family planning programs, which makes it difficult to measure their impact on reproductive behavior solely in terms of numbers of contraceptives dispensed.

Indeed, recent research shows that similar and mutually reinforcing factors are associated with both increased motivation to practice fertility control and the success of organized efforts to increase access to the means of fertility control. Policymakers and planners would like to know the relative weight of each factor in boosting contraceptive prevalence in order to allocate scarce development aid and government program funds most effectively, but singling out these weights has proven to be difficult.

Family planning effort and socioeconomic development

Demographers Robert Lapham and Parker Mauldin have tackled this question, examining the association between contraceptive prevalence rates (at some point between 1977 and 1983), family planning "program effort" during 1972-82, and socioeconomic setting in 1970 for 73 LDCs (see Table 7). Their family planning "program effort" index covers such factors as political commitment, availability and quality of family planning services, method mix, outreach, use of mass media, local financial support, and record-keeping and evaluation. Socioeconomic variables are adult literacy, school enrollment rates, life expectancy, infant mortality rates, per capita gross national product, proportions of males working outside agriculture, and proportions of total population living in cities over 100,000. The study found that both family planning program effort and "socioeconomic setting" have a significant independent effect on levels of contraceptive prevalence but their *joint* effect is much greater than the effect of either set of variables alone. There were only a few exceptions to this general pattern. In Indonesia, with a contraceptive prevalence rate of 48 percent, a "moderate" program effort evidently compensated for a "lower-middle" socioeconomic setting, and high socioeconomic settings overcame very weak program effort in Peru (43 percent contraceptive prevalence rate) and Paraguay (36 percent).

These findings are good news for family planning program managers in those

Table 7. Contraceptive Prevalence Rates, by 1970 Socioeconomic Setting Index and 1972-82 Family Planning Program Effort: 73 Less Developed Countries

1970 socio-economic setting[a]	1972–82 family planning program effort[a]								
	Strong		Moderate		Weak		Very weak or none		
	Country	Rate[b] %	Country	Rate[b] %	Country	Rate[b] %	Country	Rate[b] %	Average %
High	Hong Kong	80	Cuba	79	Brazil	50	Peru	43	
	Singapore	71	Costa Rica	66	Venezuela	49	Paraguay	36	
	Taiwan	70	Panama	63	Mexico	40			
	South Korea	58	Jamaica	55					
	Mauritius	51	Trinidad/ Tobago	54					
			Colombia	51					
			Chile	43					
			Fiji	38					
	Average:	(66)		(56)		(46)		(39)	55
Upper middle	China	69	Thailand	58	Ecuador	40	Syria	20	
			Sri Lanka	57	Turkey	40	Ghana	10	
			Philippines	45	Honduras	27	Nicaragua	9	
			Dominican Republic	43	Egypt	24	Algeria	7	
			Malaysia	42	Iran	23	Zaire	3	
			El Salvador	34	Morocco	19	Zambia	1	
			Tunisia	31	Guatemala	18			
	Average:	(69)		(44)		(27)		(8)	29
Lower middle			Indonesia	48	Haiti	19	Bolivia	24	
			India	32	Kenya	7	Zimbabwe	14	
			Vietnam	21	Pakistan	6	Lesotho	6	
							Nigeria	6	
							Papua New Guinea	5	
							Burma	5	
							Senegal	4	
							Cameroon	2	
							Liberia	1	
							Uganda	1	
							Kampuchea	0	
	Average:			(34)		(11)		(6)	11
Low					Bangladesh	19	Benin	18	
					Nepal	7	Sudan	5	
							Sierra Leone	4	
							Ethiopia	2	
							Somalia	2	
							Yemen	1	
							Burundi	1	
							Chad	1	
							Guinea	1	
							Malawi	1	
							Mali	1	
							Niger	1	
							Tanzania	1	
							Burkina Faso	1	
							Mauritania	1	
	Average:					(13)		(3)	4

Source: Robert J. Lapham and W. Parker Mauldin, "Contraceptive Prevalence: The Influence of Organized Family Planning Programs," *Studies in Family Planning*, Vol. 16, No. 3 (May-June 1985) Table 6, p. 130.

[a]For description of socioeconomic setting and family planning program effort indexes, see text.

[b]Contraceptive prevalence rate = percentage of married women of reproductive age using contraception. Data are for some point between 1977 and 1983.

countries where the combined effect of program effort and socioeconomic progress has helped accelerate recent fertility declines. However, the findings are a cause for concern about countries where family plannning effort is weak or nonex-

istent and socioeconomic levels are also low. Seventeen of the 73 countries fell into this category, almost all in sub-Saharan Africa. In those countries, the proportion of married women of reproductive age using contraception averaged 3-13 percent, compared to 44 percent and higher in countries ranked in the top two categories of program effort and socioeconomic setting.

Another concern for program planners is the apparent stalling of fertility decline in some countries. Total fertility rates began rapid declines during the 1960s in Costa Rica, Korea, Sri Lanka, and Tunisia, but the declines slowed after 1975 with the rates still well above the replacement level of 2.1 births per woman.[35] (The latest data, for about 1984, show the rates at 3.5 in Costa Rica, 2.6 in Korea, 3.7 in Sri Lanka, and 4.9 in Tunisia.[36]) In both Costa Rica and Tunisia, initially strong family planning effort appears to have slackened and actual fertility per woman is now about the family size that couples say they want, on average. In Korea and Sri Lanka the reasons for the stall are less clear, but increases in age at marriage contributed to the early decline and now that influence appears to have run its course. The stalls are troubling, because these countries were early starters in the fertility decline of LDCs and their experience may foretell what lies in store for countries where the decline has begun more recently.

Path to Low Fertility

Nowadays when we think about fertility decline, we typically take as references a starting point at the high rates of 6-7 births per woman in LDCs where there is scant fertility control and a lower limit represented by the fertility of populations with high proportions of women of reproductive age using contraception—68 percent of married women in the U.S. in 1982, for example, and 55 percent of all women aged 15-44.[37] As a rule of thumb, demographers put that lower limit at a total fertility rate of "around two," the level at which a parent generation replaces itself with a generation of children of about the same size. In actual practice, few people know or care about this fine point of demographic science; if there is any appeal in the idea of a two-child family, it is probably the desire to have both a boy and a girl.

Fertility rates in many countries could quite possibly settle at levels above or below two births per woman, at least temporarily. The stalling of fertility declines in some LDCs suggests that declines from 6-7 to 3-4 births per woman may occur more rapidly than further declines to two births. Also, once the decline from 3-4 births starts, it may not stop at two. Total fertility rates are currently below replacement level in almost all developed countries and in at least five countries still ranked as LDCs: Barbados, Cuba, Hong Kong, and Singapore, as well as China. In Western Europe, the latest rates, for about 1983, are as low as 1.5 in Austria, Italy, the Netherlands and Switzerland, 1.4 in Denmark, and 1.3 in West Germany.[38]

While the momentum of past population growth is still great enough to maintain positive rates of natural increase in most countries with below-replacement fertility, natural decrease (fewer annual births than deaths) has already begun in Denmark, Hungary, and West Germany and will soon follow in other industrialized countries. Without a rise in fertility at least to replacement level or immigration to offset natural decrease, total population in these countries will gradually decline. Future *World Population Data Sheets* of the Population Reference Bureau may be showing "population halving time" rather than "doubling time" for these countries.

The world's total population is likely to stabilize eventually, but it is quite possible that some individual countries will continue to grow well into the future while others lose population indefinitely through natural decrease (see projections for West Gemany, page 46). This

Young couple in West Germany. Natural decrease has already begun in Denmark, Hungary, and West Germany and will soon follow in other industrialized countries with below-replacement fertility.

prospect raises important questions about international demographic interrelationships. With jet-age transportation, electronic communication, and increased flows of international trade and finance, economic and social interdependence of nations is greater than ever before and likely to increase in the future. Low-growth areas will not be able to isolate themselves from neighbors' population pressures.

Politically, the most sensitive area is migration, particularly for low-natural-increase areas close to high-growth areas: Europe with North Africa and the Middle East, the U.S. with Caribbean Basin countries. Immigration from these neighboring regions is already a concern in Europe and the U.S. Europe has placed much tighter controls on immigration and the U.S. is tacking in this direction. But countering these efforts are growing pressures that stimulate emigration in countries whose populations will continue to grow because of demographic momentum, even though birth rates are now declining (see description of Mexico, page 45).

Trade and financial relationships also channel the effects of internal population pressures across international borders. Young adult age groups are growing fastest in many LDCs, as noted earlier. This means abundant labor and low wages which contribute to the price competitiveness of manufactured goods from many LDCs in international trade. This is one advantage of rapid population growth for LDCs. But it is a problem for their trading partners who industrialized earlier and now have industries having to adjust painfully to increased international competition.

Population pressures complicate the efforts of LDCs to service the large debts that many of them have accumulated. The fiscal and monetary restraint that the International Monetary Fund requires as a condition for continued international financial support is often in conflict with demands for social services and publicly financed infrastructure generated by rapid population growth. Leaders in many LDCs are grappling with choices between meeting social debts to their own populations and interest payments to foreign creditors. The choices are particularly difficult for countries that must also import food for rapidly growing populations. They must maintain their international credit ratings in order to import, but under conditions that leave little latitude for dealing with internal social needs. Their choices will affect the stability of international capital markets and, ultimately, the holdings of investors in developed and developing countries alike.

The pace of the transition to low fertility can shape population age structures in ways that create new problems. An extreme example of this is China, which has pursued a one-child-per-family policy since 1979 after several decades of high fertility. That shift has produced sharp distortions in the country's age structure: a bulge in the age groups that

Low-fertility, aging populations face the problem of who will care for the increasing proportions of elderly in future years.

will reach age 65 in the early 2000s, followed by a much smaller group to provide care for them in their old age, which in China has traditionally been a family responsibility for the younger adult generation. Chinese officials appear to be easing up on the one-child policy, at least partly in recognition of this and other problems associated with the impact of fertility waves on the age composition of the population (see description of China, page 41).

Other LDCs will have increasing proportions of elderly persons as their fertility declines. Most industrialized countries, with 10-15 percent of their populations now aged 65 and over (12 percent in the U.S. in 1985), already face something of China's problem of who will care for the elderly. For the U.S., Canada, Australia, and New Zealand, which all experienced prolonged postwar baby booms followed by fertility declines to below replacement level, the problem is similar to China's: a generation of elderly from about 2015 that will be much larger than the succeeding generation of care providers. Added to this is the fact that women in industrialized countries, who traditionally have provided most care for elderly family members, are increasingly likely to be working during the years of the life cycle when these demands are greatest.[39]

Younger non-native immigrants to countries with aging populations represent one alternative to supplying care for the aged and filling other jobs until recently occupied by younger age groups in those countries. But this option, like immigration generally, raises a host of issues about the ethnic and language composition of the receiving countries, eligibility of immigrants for social services as well as their potential contributions to the tax base at their destination, not to mention effects on the areas they leave. Most of these issues are fundamentally nondemographic, but they are part of the response to demographic processes.

Conclusion

This *Bulletin* has highlighted several important features of current world population trends. First, the post-World War II acceleration of population growth rates in less developed countries is over for most of these countries. High growth rates persist in sub-Saharan Africa and parts of Latin America and South Asia, but there are signs that these regions will soon follow the world trend toward lower growth rates. Second, while growth *rates* have declined, annual *absolute increase* in population continues to mount in many countries and will be large for several decades before tapering off and eventually falling to the low levels that have characterized most of human history. The reason for this is *demographic momentum:* when a population has a large *and* young population base, it takes a generation or more for declining growth rates to offset the numerical effect of high

continued on page 47

Population Prospects of Five Key Countries in the World Population Outlook

At a seminar convened by the Population Reference Bureau in the fall of 1985, experts in five countries that make a difference in the world population outlook were asked to describe the current demographic situation in these countries and answer key questions about their population prospects. The experts and the countries are:

Judith Banister *(Chief, China Branch, Center for International Research, U.S. Bureau of the Census):* CHINA
Arjun Adlakha *(Chief, Asia, Europe, North America and Oceania Branch, Center for International Research, U.S. Bureau of the Census):* INDIA
Edward K. Brown *(Project Officer for West Africa and South Asia, Population, Health and Nutrition Department, World Bank):* NIGERIA
Eduardo E. Arriaga *(Special Assistant for International Demographic Methods, Center for International Research, U.S. Bureau of the Census):* MEXICO
Carl Haub *(Director, Demographic Analysis and Public Information, Population Reference Bureau):* WEST GERMANY

Together with the questions posed, here are highlights from the presentations of the five experts, including their responses to questions from the capacity audience.

Banister: CHINA—*with 21 percent of the world's population in 1985. Will it meet its goal of just 1.2 billion in 2000, while easing its one-child-per-family policy?*

China is a key factor in world population prospects because its population of 1.04 billion in 1985 makes up 21 percent of world population and 28 percent of the population of less developed countries (LDCs). Also, it is so much further advanced than most other LDCs in the demographic transition from high mortality and fertility to low mortality and fertility that many LDCs are looking to it to see what Chinese policies they might adopt or adapt for their own circumstances.

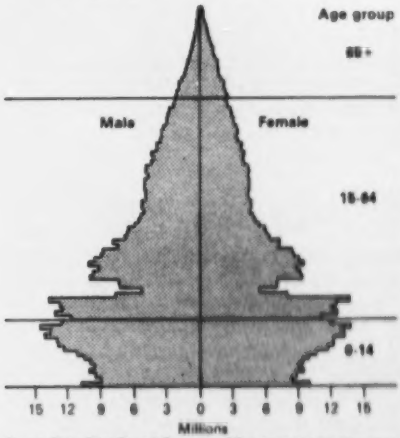
With a vigorous attack on major causes of death and emphasis on preventive and primary health care, China succeeded in increasing life expectancy at birth by more than one year each year from 1949, when the People's Republic was founded, to the mid-1970s. By 1981 life expectancy was between 63 and 66 years for males and 66 to 69 years for females—very good levels for a developing country. Further improvements in mortality will be slower because control of chronic diseases like heart disease, cancer, and stroke is more difficult than the control of infectious diseases that has been achieved.

China's total fertility rate was cut from 5.8 births per woman in 1970 to the replacement level of 2.1 in 1984. This achievement in a decade and a half was accomplished by improvements in the status of women and their greater involvement in the national economy, relatively low infant and child mortality, and a vigorous program of highly publicized, free family planning services and demographic education. Since 1979 the government has also tried to require that most couples stop at one child; this effort has largely succeeded.

Although fertility is at replacement level as of the mid-1980s, the population is still growing by just under 1 percent, or about 9 million, a year because there is a bulge of people in the young childbearing ages. The goal is a population of no more than 1.2 billion in the year 2000. This can be done if the total fertility rate is held at about 1.75 births per woman for most years to 2000. So, with its ability to compel most couples to stop at one or two births, the government is likely to achieve its target.

With population growth reduced to below 1 percent a year, China has solved the problem of increasing food production and overall economic growth faster than population; per capita income and food supplies are expected to increase each year to 2000. The societal costs and burdens of child dependency will lessen as numbers of children decline and the aged dependency burden will increase only slightly as the elderly aged 65 and over increase only from 5 to 7 percent of the total population between the

China Population Age Pyramid, 1982



Source: China State Council Population Office, based on the 10 percent sample of 1982 Census questionnaires.

mid-1980s and 2000. The big shifts in the working-age population are the challenge for the next 15 years. From now to the mid-1990s, entry-level employment must be found for the large cohorts who were teenagers at the time of the 1982 census (see 1982 population age pyramid). Continued meaningful employment will be required for these cohorts by 2000 when they will be in their late twenties and early thirties. With its current economic boom, China is already having some success in alleviating some of the unemployment and underemployment problem. In rural areas, visible unemployment or underemployment is estimated at around 30 percent of the labor force since the commune system was replaced in the early 1980s with the much more efficient agricultural production responsibility system. To alleviate this, the government has opted to introduce agricultural mechanization only gradually.

The government is aware of and planning to deal with the problems caused by the age structure discontinuities resulting from rapid fertility and mortality decline. If fertility were kept strictly to one child per woman over the long term, the total population would decline to about 700 million by about 2050 but some 40 percent of the population would be aged 65 and over. The working-age population might be unwilling or unable to care for an elderly population comprising more than about 20 percent of the total population. The proportion of the aged can be maintained near 20 percent if fertility is kept at or just below replacement level from the mid-1980s to the middle of the next century. With that goal in mind, the government is already easing the one-child policy, which is seen as being for this generation only. The government wishes to prevent almost all couples from having a third or higher order birth, but some couples are now being allowed to have a second birth. A two-child limit for all is expected to be reintroduced after the turn of the century. Also anticipating the problems of aging of the population in the distant future, the government has already set up a national commission on aging.

From China's very large national fertility survey of late 1982, there was some evidence of a disproportionate number of males compared to females among third and higher order births in 1981, suggesting some resurgence of female infanticide or selective neglect of females which was evident from unbalanced sex ratios at most ages in the Chinese population before 1949. The resurgence of this phenomenon has been linked with the one-child policy in force since 1979. But the statistical evidence is indirect and the unbalanced sex ratios could be caused in part by underreporting of female births.

Adiakha: INDIA—*768 million in 1985 and catching up fast with China. Will the leadership's call for a revitalized family planning program result in slower population growth?*

India's population was over 768 million as of mid-1985 and growing at 2.1 percent a year, according to estimates by the U.S. Census Bureau. At this growth rate, resulting from a birth rate of about 34 per 1,000 population and a death rate of 13, India is adding about 16 million persons annually, compared to 9 million in China, and will overtake China as the world's most populous country by 2020, according to current medium projections of the Census Bureau.

India's 1981 census revealed that the an-

nual growth rate had leveled off at just over 2 percent during the 1970s after rising during the 1950s and 1960s as death rates fell faster than birth rates. However, the 1981 total population count was 12 million more than projected by Indian planners. This prompted the nation's political leaders to renew support of the family planning program, which had existed since 1952 but languished since 1977. This stagnation reflected a backlash to the allegedly coercive sterilization drive of 1976-77, which was a major reason for Prime Minister Indira Gandhi's election defeat in March 1977. The 20-point National Health Policy of 1983 set a target for 2000 of a "net reproduction rate of unity"—the equivalent of replacement level fertility of about 2.3 births per woman—down from the current level of about 4.3 births per woman. To achieve this, about 62 percent of couples of reproductive age would have to be "effectively" protected against pregnancy, that is, using modern contraception. As of 1985, the estimated figure was about 32 percent.

The strategy for the reinvigorated family planning program, detailed in the 1982-83 annual report of the Ministry of Health, calls for placing in each village of over 1,000 which is not covered by a health center a voluntary "health guide" to promote family planning and distribute condoms and pills, aided by trained midwives to act as motivators. It also calls for more emphasis on birth-spacing methods, including the pill, and increased incentives; for example, a proposal is that couples accepting sterilization after two children would receive 50 rupees a month (about U.S. $4) or a bond of 100,000 rupees to be cashed after 20 years if the two children are girls. And family planning activities are to be better coordinated with other development plans as well as with maternal and child health services.

Since 1981 the family planning program has made some progress. The percentage of couples "effectively protected," which had hovered at 22-23 percent since 1978, rose to 32 percent by 1985. However, this was four points short of the goal of 36 percent for this year.

The consensus of projections prepared by the Indian government, the United Nations, the World Bank, and the U.S. Census Bureau is that India's population growth rate will decline to about 1.6 percent a year by 2000 and slightly below 1 percent by 2025. Most Indian couples now seem to feel the need for smaller families to meet changing social and economic conditions. The family planning program can reinforce the resulting demand for contraception by providing information and incentives. However, a review of current population projections and expert opinion concludes that replacement level fertility is unlikely by 2000, although it could be reached by 2010. A major reason for this is slow progress in reducing infant mortality and increasing female literacy, which is linked to low family planning acceptance in some of India's most populous states. For example, in the four northern states of Rajasthan, Madhya Pradesh, Uttar Pradesh, and Bihar, comprising almost 40 percent of the total population, only 13 to 18 percent of females were literate in 1981 and infant mortality ranged from 108 to 150 deaths per 1,000 live births. Only 11 to 22 percent of couples were using modern contraception in 1982 and birth rates in 1983 were still 37 to 40 per 1,000 population (see top of table). Thus, reaching reaching the 62 percent of

India and 16 Largest States: Recent Population Statistics

State	Crude birth rate[a] 1983	Percent of couples effectively protected[b] 1982	Percent of literate females 1981	Infant mortality rate[c] 1981
All India	33.6	23.7	26.5	100
Rajasthan	40.0	14.5	13.4	108
Madhya Pradesh	38.5	21.8	18.0	142
Uttar Pradesh	38.4	11.3	16.3	150
Bihar	37.2	12.2	15.8	116
Haryana	35.9	28.6	25.8	101
Assam	34.1	18.3	—	106
Gujarat	34.0	34.9	37.0	116
Orissa	33.3	26.1	24.0	135
West Bengal	31.9	24.4	34.4	91
Jammu and Kashmir	31.4	10.8	—	72
Andhra Pradesh	30.7	27.2	23.2	86
Punjab	30.2	27.4	38.3	81
Maharashtra	29.6	36.7	39.6	79
Karnataka	28.7	24.7	35.3	69
Tamil Nadu	27.8	27.7	39.4	91
Kerala	24.9	32.0	73.4	37

Sources: Official Indian government sources and World Bank.
[a]Births per 1,000 population. [b]Couples of reproductive age using modern contraception.
[c]Deaths under age one per 1,000 live births.

couples practicing contraception which would be required for replacement level fertility seems unlikely by 2000.

Also unlikely is that desired family size will be as low as the two-child norm by 2000. Even in Maharashtra state, where the percentage of couples effectively protected against pregnancy was highest in 1982 at 37 percent, the average ideal number of children reported by women having a sterilization in the early 1980s was 2.0 sons and 1.3 daughters in rural areas and 1.7 sons and 1.2 daughters in urban areas.

In the summer of 1985, Prime Minister Rajiv Gandhi, for the first time since succeeding his mother a year earlier, publicly declared on several occasions that population control is India's biggest problem and called for new strategies to invigorate the family planning program and to upgrade women's education, which he pinpointed as essential to reducing birth rates. In Kerala, with the highest percentage of literate females in 1981, 73 percent, the birth rate was lowest in 1983, 25 per 1,000 population (see table). The leadership's renewed commitment to reducing population growth is a positive development. However, this commitment must be accompanied by appropriate funding and there must be concomitant development, especially in the areas of infant and child survival and female literacy, to achieve faster acceptance of family planning and, in turn, more rapid decline in the country's birth rate.

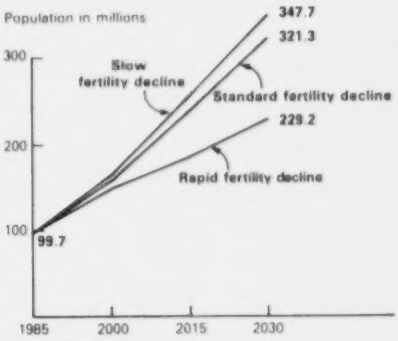
Brown: NIGERIA—*population giant of the world's fastest-growing region. What are the prospects for a population growth slowdown?*

Nigeria, the demographic giant of the world's fastest-growing region, sub-Saharan Africa, is projected by the United Nations to become the world's third most populous country by 2030, after China and India. Estimates of the country's population are necessarily derived from the only officially accepted census so far, that of 1963, when the population was around 55.7 million. The estimate for 1985 is 99.7 million. No state-level estimates are possible.

The birth rate of 1985 is estimated at close to 50 births per 1,000 population and the death rate at 17 per 1,000, yielding a natural increase rate of 3.3 percent a year. With 48 percent of the population under age 15, there is a tremendous built-in momentum for future population growth. The total fertility rate according to the national fertility survey conducted in 1982 as part of the World Fertility Survey is 6.3 births per woman; the World Bank puts it at 6.9 births per woman. At the time of the 1982 survey, only 6 percent of married women aged 15-49 were using contraception. From small-scale surveys, infant mortality is estimated to be 113 deaths per 1,000 live births and life expectancy at birth is put at about 48 years, with the figure slightly higher for females than for males.

Three projections of Nigeria's population from 1985 to 2030, prepared by the World Bank, illustrate the impact of differential timing of fertility decline (see figure). The two highest projections assume that fertility drops to replacement level—a total fertility rate of about 2.1 births per woman or a "net reproduction rate" of one—by 2035. In the "standard" fertility decline scenario, the decline is assumed to begin in 1990 and the

Nigeria's Population, 1985-2030: Three Projections



Source: World Bank projections.

Slow fertility decline — Fertility begins decline in 1995; reaches replacement in 2035.
Standard fertility decline — Decline begins in 1990; reaches replacement in 2035.
Rapid fertility decline — Decline begins in 1985; reaches replacement in 2005.

total population in 2030 would be 321 million—an increase of more than three times in 45 years. If the start of the decline is delayed to 1995, as in the "slow" fertility decline scenario, the population in 2030 would be 27 million more—348 million. The third projection makes the unlikely assumption that fertility declines rapidly, beginning in 1985, to replacement level in 2005; in that case, the population in 2030 would be 229 million—92 million less than in the "standard" scenario.

The prospects for a slowdown in Nigeria's population growth rate hinge on the pace of social and economic development and the level of national commitment to population control. Socioeconomic development is hampered by the severe financial constraints that Nigeria—like most sub-Saharan African countries—is now facing. However, in the past two years there has been a growing consensus among Nigerian leaders that the country's rapid population growth is inimical to economic progress and increased commitment to addressing the issue directly. Privately, also, some Nigerians are coming to realize that the rising costs of children require smaller families, though this is not yet true among the 77 percent of the population living in rural areas.

The leadership has identified adequate birth-spacing as both beneficial to the health of mothers and children and a central factor in slowing population growth. Thus, the Ministry of Health was mandated to prepare a national population policy and program to be incorporated into the forthcoming fifth five-year (1987-1991) development plan. There is now a draft first national population plan of action which includes voluntary family planning as a major component. Among its goals, the plan proposes to encourage marriages delayed until after women reach age 18, promote birth-spacing of at least two years, and reduce the number of pregnancies before age 18 and after age 35. Special targets are to reduce average lifetime births, now over six, to four by the year 2000 and to reduce the current population growth rate of 3.3 percent a year to 2.5 percent by 1995 and 2.0 percent by 2000. In addition, it is proposed to make available suitable family life education and family planning information and services to all adolescents by 2000.

There appears to be increasingly strong leadership commitment to tackling the population problem and there is a good chance that the plan of action will be adopted during 1986.

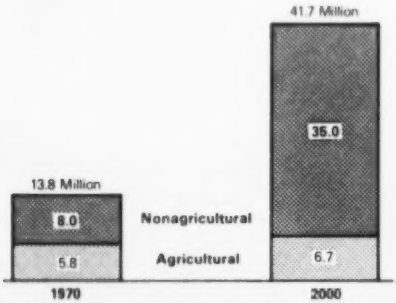
Arriaga: MEXICO—*the U.S.'s populous neighbor. What does Mexico's population future portend for the U.S.?*

After rapid mortality decline during the 20th century, Mexico's life expectancy at birth reached the relatively high level of 67 years by 1980. With the government still encouraging high fertility, the total fertility rate remained at 6.8 births per woman until the early 1970s but then, following implementation of a strong family planning program, fell to 4.3 in 1982. Recent projections by the Center for International Research of the U.S. Census Bureau assume that Mexico's fertility rate will continue to fall to 2.9 in 2000 and 2.3—close to replacement level—in 2010. The rate of natural increase (births minus deaths) is assumed to decline from 2.6 percent a year in 1985 to 1.5 percent about 2010. Despite this slowdown in the growth rate, Mexico's total population is projected to grow from 70.1 million in 1980 to 112.8 million in the year 2000, an increase of 61 percent in 20 years. These projections assume net outmigration of 65,000 a year.

The projected growth in Mexico's labor force portends increasing pressure to migrate out of the country. With underemployment and unemployment at high levels, outmigration—whether documented or undocumented—is already heavy. As a reflection of the national population growth rate some 15 years earlier and declining mortality, the population in the working ages (15-64) is likely to continue to grow at 3 percent a year up to the end of this century. Total numbers in the labor force—persons aged 15 and over who are working or looking for work—are expected to more than double between 1980 and 2000, from 20 million to 42 million.

Since most of Mexico's projected total population growth to 2000 is expected to be

Mexico's Agricultural and Nonagricultural Labor Force, 1970 and 2000



Source: Projections by Center for International Research, U.S. Bureau of the Census.

absorbed by urban areas, most labor force growth in turn will take place in the cities, where unemployment is already particularly high. In the 30 years from 1970 to 2000, the urban population is projected to increase nearly three times, from 30.5 million to 84.6 million. At the same time, if rural and urban economic activity rates remain as they were in 1970, the nonagricultural labor force will increase more than four times, from 8 million to 35 million (see figure). This will create a major increase in the demand for urban jobs which, if it cannot be met by the Mexican economy, is likely to enhance the potential for outmigration.

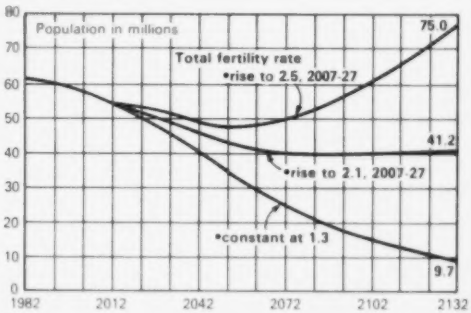
Such a potential is even clearer when compared to the situation in the United States. During the five years from 1995 to 2000, Mexico—with less than 50 percent of the total population of the U.S. at that time—will be adding almost as many people to its labor force each year (1.2 million) as will the U.S. (1.3 million). This situation is inevitable since all Mexicans who will be in the labor force in 2000 are already born. The heavy outmigration of Mexicans seems to be related to the job market. Without a rapid increase in modern jobs available in Mexico, the pressure to migrate out of the country in search of work is only likely to increase.

Haub: WEST GERMANY—*an extreme example of a low-fertility developed country, with the world's lowest total fertility rate and a declining population. What lies ahead?*

West Germany's total fertility rate dropped to 1.3 births per woman in 1984—probably a record low for any country—and has been below the replacement level of 2.1 births per woman since 1969. As a result, the country is now experiencing natural decrease (annual deaths exceed annual births) and net migration has also been outward in recent years, so population numbers are declining. Thus, West Germany can be taken as a dramatic example of what could be in store for other countries of the developed world comprising a quarter of global population if the below-replacement fertility that most of them now have is sustained past the point where birth and death rates meet into a future "beyond the demographic transition." These countries may have to cope with indefinite population decline and aging, just as some less developed countries may never completely stop growing, even though population growth on the world level is likely to balance out at zero in the long run.

Some West Germans see advantages in a small decline in the current population of 61 million crowded into an area the size of the

West Germany's Population, 1982-2132: Three Projections



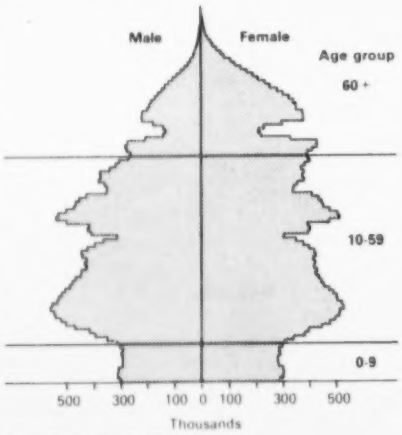
Source: Population Reference Bureau projections

state of Oregon. But few would welcome the drastic declines revealed by Population Reference Bureau projections for the 150 years from 1982 to 2132. If the total fertility rate were to remain constant at 1.3 births per woman, the population of 2132 would be just 9.7 million—16 percent of its size in 1982 (see projections, bottom line). Even if fertility moves back up to the replacement level of 2.1 by 2007 and stays there, the population would continue to decline, leveling off at about 41 million by 2132 (middle line). This results from what might be called the "reverse momentum" phenomenon—the opposite of the momentum effect which ensures continued population growth for a generation or two after fertility drops to replacement level in populations with disproportionate numbers of young people. The reverse momentum phenomenon means that West Germany's population would continue to decline even if fertility rises above replacement to 2.5 in 2007 and remains there, although in this case, growth resumes after several decades. The population would be back up to its 1982 level of 61 million by 2100 and would be 75 million in 2132.

It has been suggested that West Germany can look to higher fertility among its foreign-born minority to help keep up birth rates. However, immigration of guestworkers has been limited since the recession of the early 1970s and those already in the country have been encouraged to return to their home countries. This policy appears to have been successful; net outmigration was 117,000 in 1982, of which the vast majority was accounted for by the foreign-born. Also, births to the foreign-born have dropped from 20 percent of total births in 1974 to about 12 percent currently.

The likelihood of continued population decline is also evident in West Germany's

West Germany Population Age Pyramid, December 1983



Source: Federal Statistical Office, Bonn

population age structure as of the end of 1983 (see population pyramid). The youngest cohorts, under age 10, are very small, which means that population decline is inevitable in the next few decades unless births per woman rise dramatically, which is unlikely.

This same age structure shows the relatively high proportion in the oldest ages. If fertility were to remain at 1.3 births per woman, by about 2030 some 40 percent of the population would be age 60 or more.

West Germany, like most European countries, is well aware of and concerned about the implications of continued very low fertility. Who will run the nursing homes and fill the labor force of the future? Without immigration, there appears to be no solution.

Conclusion

continued from page 40

growth rates in the past. Third, most (95 percent) of the large future increase in world population will occur in LDCs, including some of the poorest regions of the world—sub-Saharan Africa and South Asia (Bangladesh, India, Pakistan, etc.). Finally, the length and direction of the path toward low population growth rates and eventual stabilization of world population size are not yet fully charted,

although there are important economic, social, and political implications for present as well as future generations that depend on the nature of that transition.

Most demographers project substantially lower population growth rates during the next century and attainment of a stable, or nearly stable, world population toward the end of that century. The current "medium variant" long-range projection of the United Nations puts that stabilized world population at about 10.2 billion, reached around 2095, up from an estimated 4.9 billion as of mid-1986. Most industrialized countries already have fertility rates that are lower than the replacement level of about two births per woman and a few are already experiencing natural decrease (fewer births than deaths). While fertility rates have fallen in LDCs, almost all—China's being the major exception—are still well above replacement. The pace of their decline to replacement will determine the ultimate size of these populations when stabilization occurs.

The increases in numbers that have occurred and are likely to occur in LDCs are unprecedented, and a cause of concern to many. Gaps in living standards between less and more developed countries remain large, and the fact that so much of the projected increase in world population will come in LDCs raises the possibility that population growth will stymie efforts to raise living standards among the large proportions of poor people in these countries. Early assessments of the adverse effects of rapid population growth on development, in the 1950s and later, simplified and sometimes overstated the benefits of slower population growth. Linkages between population growth and structure and important developmental variables, such as investments in human and physical capital, have hinged on institutional and political changes whose effects are difficult to quantify in terms that would allow assignment of an independent role to population growth. Rapid population growth appears to play an "accomplice" role in many development problems. Rather than being the root cause of the problem, it exacerbates or magnifies the effects of bad management, poor planning, and scarcity or misallocation of resources.

But while rapid population growth may exacerbate problems, slower growth will not alone solve them. Thus, thinking about the role of population in development and development assistance strategies has shifted toward a more integrated view. This recognizes the complementary and often mutually reinforcing relationships between efforts to slow population growth and other development efforts—to improve people's health, nutrition, and education, upgrade the status of women, increase productivity, introduce better management of agriculture, etc.

Organized efforts to increase access to family planning information and supplies have expanded rapidly over the past two decades and are associated with significant increases in contraceptive prevalence and declining fertility in many LDCs. Here, too, it has been difficult to single out the independent effect of organized program efforts from that of other development variables, such as increasing education and per capita income, because these variables complement and reinforce each other. Research on the determinants of contraception and fertility shows that a growing share of couples want to plan smaller families for reasons of health and achievement of personal aspirations, whether or not they perceive the effects that their actions may be having at the societal level.

The rationale for organized interventions to increase awareness of the benefits of smaller families and increase access to methods for controlling fertility is generally based on the judgment either that the family size that couples feel is best for them is larger than the size deemed best for society or that markets are not doing an adequate job of providing information and services required for couples to achieve the "right" family

size. Such judgments involve both factual information about the determinants and consequences of population change and a set of values about the relative weights to be assigned to individual and societal goals, the distribution of wealth and power within and between societies, and the welfare of present generations versus their obligations toward future generations.

The factual questions have turned out to be more complex than many had imagined. Yet those responsible for making decisions about development assistance and strategy have to make choices even if the information to support a given choice is not clear-cut. In the last account, many decisions to intervene in population matters have been based on administrative judgments that involve more common sense than clear-cut research findings.

Since these interventions also involve basic and often conflicting human values—individuals' rights to control their own fertility versus their responsibilities to others—population policy remains a controversial area. If demography and related disciplines can build a better factual base for these judgments, they may help to narrow the realm of controversy. Hopefully, they can better inform the judgments of those concerned with value issues and those who must make decisions for action. □

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